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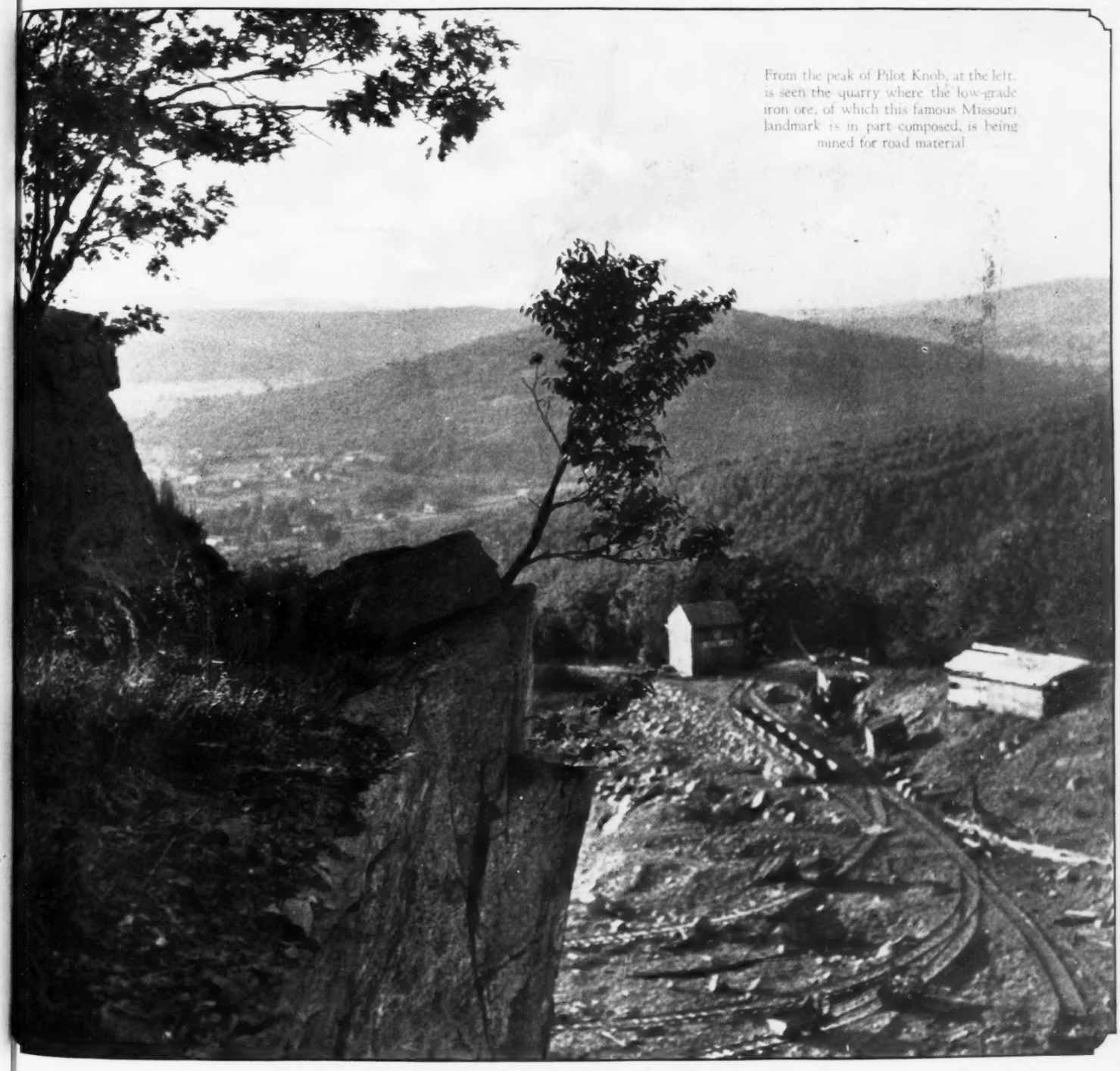


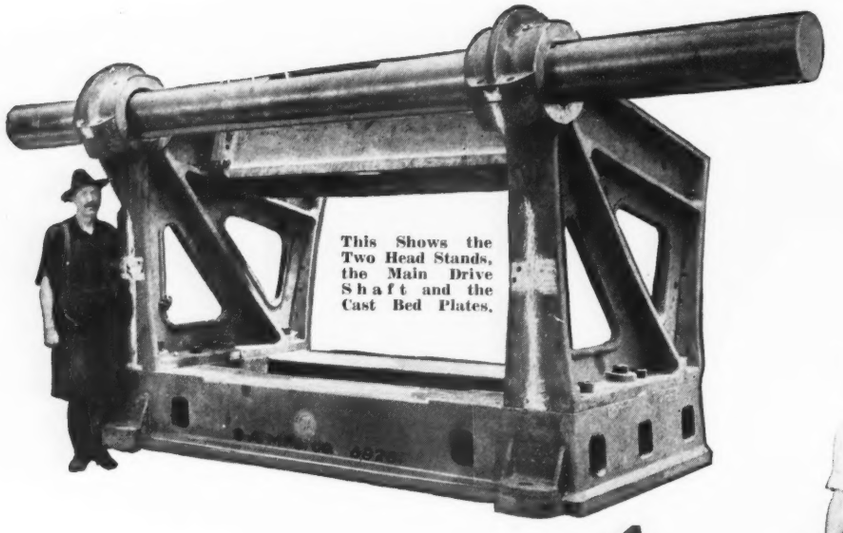
From the peak of Pilot Knob, at the left, is seen the quarry where the low-grade iron ore, of which this famous Missouri landmark is in part composed, is being mined for road material

Iron Ores of Iron Mountain and Pilot Knob, by J. E. Spurr

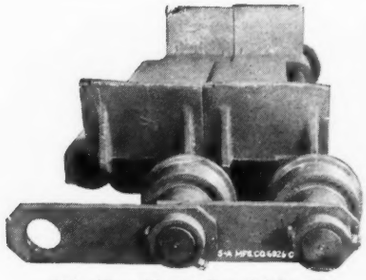
Shaft Sinking Today at Butte, by Howard Drullard

Electric Improvements in Lake Superior Fields, by Edgar Gealy

Heavy ore feeders that handle large tonnages with low cost for upkeep



This Shows the Two Head Stands, the Main Drive Shaft and the Cast Bed Plates.



This View Shows Two Links of One of Two Matched Strands of Chain

Interlocking 72-inch wide conveyor pans with integral side plates. Note independent traction rolls and chain rollers.

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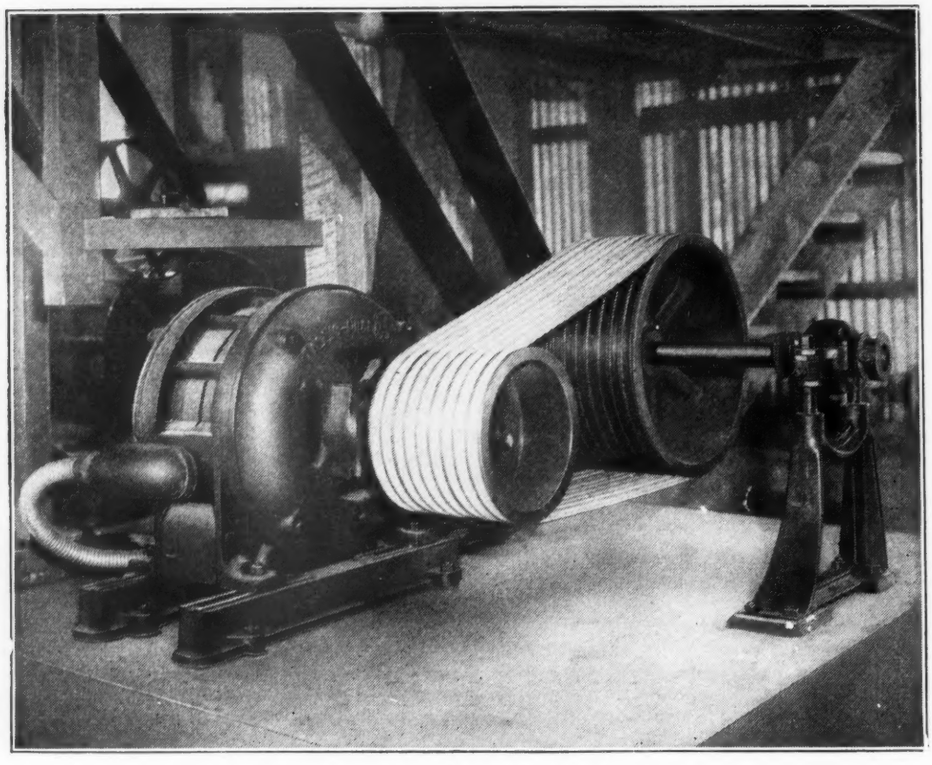

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ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

Volume 123 | New York, February 26, 1927 | *Number* 9

The Government in Business

THIS IS THE AGE OF ADVERTISING. Advertising, we gather from certain enthusiastic exponents, is scarcely less elevating than religion, and is far more common. Advertising forms the main support of practically all magazines and newspapers, and makes possible the issue of countless minor sheets. It pays the bill for the dissemination of information to the civilized world. The organs of learned societies, like the American Institute of Mining and Metallurgical Engineers, solicit advertising, without which they could not pay their printers' bills. Advertising appears on our rural scenery: and if we cast our eyes to heaven, which is always the last desperate act of mankind, we see in gigantic letters the advertisement of a cigarette written in smoke from a circling airplane.

All this is true of America, internationally known for its great attachment to the dollar. But it is England which furnishes us with the latest word in advertising advance. A bulletin of the Mines Department, containing the reports of His Majesty's Inspection of Mines for 1925, has just arrived: printed and published by His Majesty's Stationery Office. It is No. 8: doubtless it simply represents the usual practice, though previously unnoticed. It contains forty-six pages of text and fourteen pages of advertisements of mining machinery and supplies. The bulletin has sold its back cover to an advertiser. His Majesty's Government is to be congratulated at not having capitulated to its advertising solicitors so far as to sell the front cover, but that may come in time.

Nevertheless, the Government officially does not desire to associate with the advertisers: a statement reads:

"The Government accept no responsibility for any of the statements in the advertisements appearing in this publication, and the inclusion of any particular advertisement is no guarantee that the goods advertised therein have received official approval."

"Caveat emptor," says His Majesty's Government in effect; "we have taken these advertisers' money, but we do not know or care if their goods are good." Therein it exerts less censorship over its pages than *Engineering and Mining Journal,* which, following the example of most high-class publications, does not accept advertisements for goods not known and approved and does not accept advertisements worded improperly or misleadingly. Our own private commercialism is not so hard-boiled as that of H. M. Government.

There are certain forward steps in the downward path against which we would warn H. M. Government. Do not adopt the style of publishing where a column of text is sandwiched in between two columns of advertisements. This is practical in non-technical publications, like the *Saturday Evening Post,* without much damage: the object, of course, is to make the reader see the advertisements, and the disposition of the text is a lure. But in technical publications the next step urged by those interested is to have the text harmonize with the advertising columns on either side. Therefore this arrangement is taboo in all the publications of the McGraw-Hill company. Also, the Secretary for Mines should withstand the tendency for his advertising solicitors to put something in the text which will be regarded by the advertisers as a little velvet—a special department for new machinery, and so on. We do this, and believe it proper: it interests our readers, the machinery buyers, and users—and what is so important as the mechanization of mines? But we represent a frankly industrial and commercial undertaking. Therefore we are not quite so sure of the dignity of such approved editorial customs when applied to the organ of a purely technical society, such as *Mining and Metallurgy,* a journal whose general conduct we commend; and we would hesitate, as conservative experts, in recommending it for the publications of His Majesty's Government.

Mixed with these reflections, there is doubtless a tinge of nationalistic jealousy. Has Mr. Coolidge in his Campaign for Economy, overlooked a bet? Has Mr. Hoover with his Elimination of Waste, been passed in the race? Should not the *Commerce Monthly,* issued by the Department of Commerce, carry advertising? It would pay. What the Bureau of Mines needs in the way of extra money, and cannot get, would be easily earned in this way, without begging Congress. Should not the reports of the Bureau of Mines and the bulletins be financed in part at least by appropriate advertising? We cannot think that the Stars and Stripes, which invented dollar diplomacy and floats over the world's champion go-getters (if you ask them), will long suffer this challenge by the Union Jack. Speed the day when the President's Thanksgiving proclamation carries an advertisement of Long Island Ducks!

Branch Banks and Branch Mining Schools

AS A PARALLELISM to the branch-bank epidemic, there now arises the possibility of the branch mining school. As an example there is to be found among the 2,000 proposed laws, more or less, submitted to the present Legislature of California, an Assembly bill providing for the establishment of a college of mining, to be known as the "California College of Mining," a northern branch of the University of California, at or near Redding, Calif. An appropriation of $1,500,000 for the purchase of land, construction of buildings, equipment, and management is also requested.

This is unwise and unnecessary legislation. Apparently it is a case of exploiting a state for sectional advantage. A mining school at Redding would have no specific advantages. There are already two long-established mining schools in California, one at Berkeley and one at Stanford University. Attendance is not large at either. A general survey of the mining-school

situation would indicate a large excess in number, equipment, and facilities afforded by mining schools in comparison with the existing demand. Facilities for transportation have so improved that there is neither economy nor need in detached schools. Regional rather than state schools would be in the interests of efficiency and, in addition, would be of greater value to students of mining.

Spending the other fellow's money appears to be a favorite sport of the legislatures, but in this instance there would be no compensating advantages to the mining industry.

The West Comes to New York

FLAVORED WITH THE SPIRIT OF THE WEST was the annual dinner of the American Institute of Mining and Metallurgical Engineers in New York on Feb. 16; and appropriately so. The incoming president, E. L. De Golyer, though now a resident of the island of Manhattan, was born in Kansas and was educated at the University of Oklahoma. Most of his professional work has been done in the West and in Mexico.

Of the three recipients of honorary awards, all are essentially Westerners. Zay Jeffries, to whom was presented the James Douglas Medal for distinguished achievement in non-ferrous metallurgy, was born in South Dakota and graduated from the School of Mines of that state. One of his early jobs was that of superintendent for the Ideal Mining Co. at Custer. Even today the magnet that is New York has not drawn him nearer to itself than Cleveland, Ohio.

Thomas L. Joseph is a native of Utah and graduated from the Utah School of Mines. In recognition of his work in research connected with the blast-furnace smelting of iron ore, he was chosen to receive the J. E. Johnson, Jr., award. He is now superintendent of the North Central Experiment Station of the U. S. Bureau of Mines, at Minneapolis.

Canada was the birthplace of David W. Brunton, recipient of the William L. Saunders medal for achievement in mining. But Mr. Brunton has made his home in Denver, Colo., for many years and he typifies the West. Though he has behind him a varied record of achievement, Mr. Brunton probably is best known because of the pocket transit that he invented and that bears his name. The average engineer, starting on a trip of exploration or entering a strange mine, would be almost as likely to leave his shoes behind as his "Brunton."

In these circumstances it was more than fitting that Thomas (better known as "Tom") Stearns, of Denver, should be master of ceremonies at the dinner. His expatiation on the salubrity of Colorado's climate, that must have aroused envy in the hearts of the Californians and Floridans (if any) among his hearers; his stories, good, bad, and indifferent, but all told with zest; his sincere, but not fulsome, eulogy of his friend Brunton; his staging of a little radio stunt purporting to record the shots that "holed through" the Moffatt tunnel that penetrates the back of the Rockies between Denver and Salt Lake; his engaging geniality; and his eloquence, sometimes serious and sometimes tinged with mockery; all these savored of the West. It was a night for Western men, and everybody who had the privilege of being present seemed to enjoy it.

The Institute Meeting in New York

THE ANNUAL MEETING of the American Institute of Mining and Metallurgical Engineers in New York, Feb. 14 to 17, was generally voted a successful one. The registration was large, which is the first requisite for success. Analyzing the benefits of such a meeting, the most important feature is doubtless in the occasion and opportunity for a rendezvous of the widely scattered representatives of the mining industry. Countless old friendships and acquaintanceships are renewed, and many little matters of personal interest talked over which otherwise would not get to be discussed. From this social contact new ideas also originate, and new orientations on matters of general and personal interest, so that the general alignment is improved.

The technical sessions are manifestly the substantial background and motive for the meeting, and are accessible to and valued by the specialists in each subject. There are many, however, like the Secretary of the Canadian Institute, who stated that he had not attended the technical sessions but was nevertheless well repaid for coming. Lunches and dinners of various groups help in the general intermingling and contribute to the clearing-house process. The smoker evening falls into the same category—the active interchange of ideas, under no better stimulant than near-beer, gradually increased in intensity until the very excellent program was inaudible.

Confessedly, the banquet is the most difficult part of the annual program, because the most formal. The incoming and outgoing presidents testified that they had been instructed by this dinner committee to cut it short, and they did their duty as they saw it. The pleasant ceremony of presenting medals proved to be perhaps a little complicated and extensive for the volatility of the banqueters.

An admirable innovation was the emphasis laid on the annual business meeting, for which a bid for attendance and discussion was strongly made by the directing officers. Whereas in former years the rule had been to make this a mere formality, to allow only a little time, and to look with coldness upon remarks by the members, this year the technical sessions were suspended during the business meeting, with the result that several hundred attended. The report by the directorate of a plan to raise the dues, presented as a tentative one, brought free discussion and considerable opposition from representatives of Western sections; and this criticism was received in a spirit of attention and appreciation. The report on the policy and budget of *Mining and Metallurgy*, briefly made, was not offered for discussion, a procedure which, be it noted, was not criticised.

Altogether, the impression derived from the meeting was one of improvement in management and consequently in spirit; and it is fair to assume that this spirit—a contagious one—may be traced to the officers and directors.

One outstanding fact appears as the basis for all discussion—namely that the February meeting of the A.I.M.E. is the largest gathering of mining and allied engineers in the world; and when one considers the wealth of personality and experience here assembled, it is impossible to regard it otherwise than well worth while.

Missouri Plans to Combine Fishery, Forestry, and Geology Bureaus

THE REORGANIZATION IDEA has struck the State Legislature of Missouri. The powers that be have discovered that there are at least a hundred various commissions, bureaus, and boards ranging from geology to chiropractic, and a plan of reorganization of the State Executive Department into seven divisions has been launched. At the head of each of these divisions will be a salaried commissioner appointed by the Governor. The commissioners will act as a Cabinet for the Governor, similar to the President's Cabinet. This reorganization and appointment of commissioners and assistants is to be done independently of any merit system, for at present there is no civil service law under which these appointees can be chosen. If the merit system were in vogue, with a civil service roster to select from, a more appropriate staff could be established—one in which technical positions would at least be filled by men experienced in the work for which they were selected.

It is proposed that one of the divisions be known as the Department of Conservation, in which will be included the present Game and Fish Commission, the Forestry Bureau, and the State Geological Survey. The Game and Fish Commission now employs something like fifty men, most of whom are game wardens, and collects annually about $150,000 from the issuance of sport licenses. There is no overhead expense, as the Commissioner reports direct to the Governor. The Forestry Bureau reports to the State Board of Agriculture. The State Geological Survey is under a board of four members appointed by the Governor, none of whom draws a salary; and the only expenses that are incurred are those incident to attending meetings, amounting to perhaps $250 per year. The annual mineral production of the state is approximately $90,000,000 per year. It is natural to fear, in view of the larger number of employees in the Game and Fish Commission, that the Commissioner of the new Department of Conservation would be a politician-sportsman. He, of course, would also have a staff of employees and assistants, who would not be under civil service. With the State Geological Survey subordinated to a politically appointed Commissioner, the work of the State Geologist might be hampered.

The State Geological Survey does not need to be hooked up with the Game and Fish Commission and the Forestry Bureau. It is already highly useful and is efficiently administered.

For the last twenty years the State Geological Survey has been independent of politics, the same incumbent being continuously reappointed regardless of political changes in the administration. He is the oldest commissioned officer in point of service in the state. In addition to being the Director of the Geological Survey, he is also a member of the Highway Commission, and as such has performed a valuable service to the state. The State Geological Survey has been and is being conducted in a most able manner, and any change in its functions or organization would be a detriment to the state. The Geological Survey should be kept out of politics and be retained under the control of a technical and scientific board which will insure the appointment of men of demonstrated ability and experience.

Fitting the Graduate to the Job

ENGINEERING STUDENTS of McGill, Queens, and Toronto universities, and possibly that at London, Ont., will find a friend indeed on graduation in an organization that has recently been formed. For its object this body will seek to appraise the capacity of each graduate and get him into work for which he is best adapted. At the same time it will endeavor to educate the manufacturer as to the advantage of employing technical men. The two objects thus will supplement each other.

Back of the movement are the Ontario Mining Association, the Canadian Manufacturers' Association, and the Toronto Board of Trade, as well as several individuals. Funds to keep the wheels moving for the first three years will be furnished by the sponsors, and after that it is hoped the organization will be self-supporting.

Presence of the manufacturers themselves among the sponsors would indicate that they are already persuaded that it is worth while to take technical men in their employ. Likewise, the representation of the mining companies shows that the mining students' interests are not to be neglected.

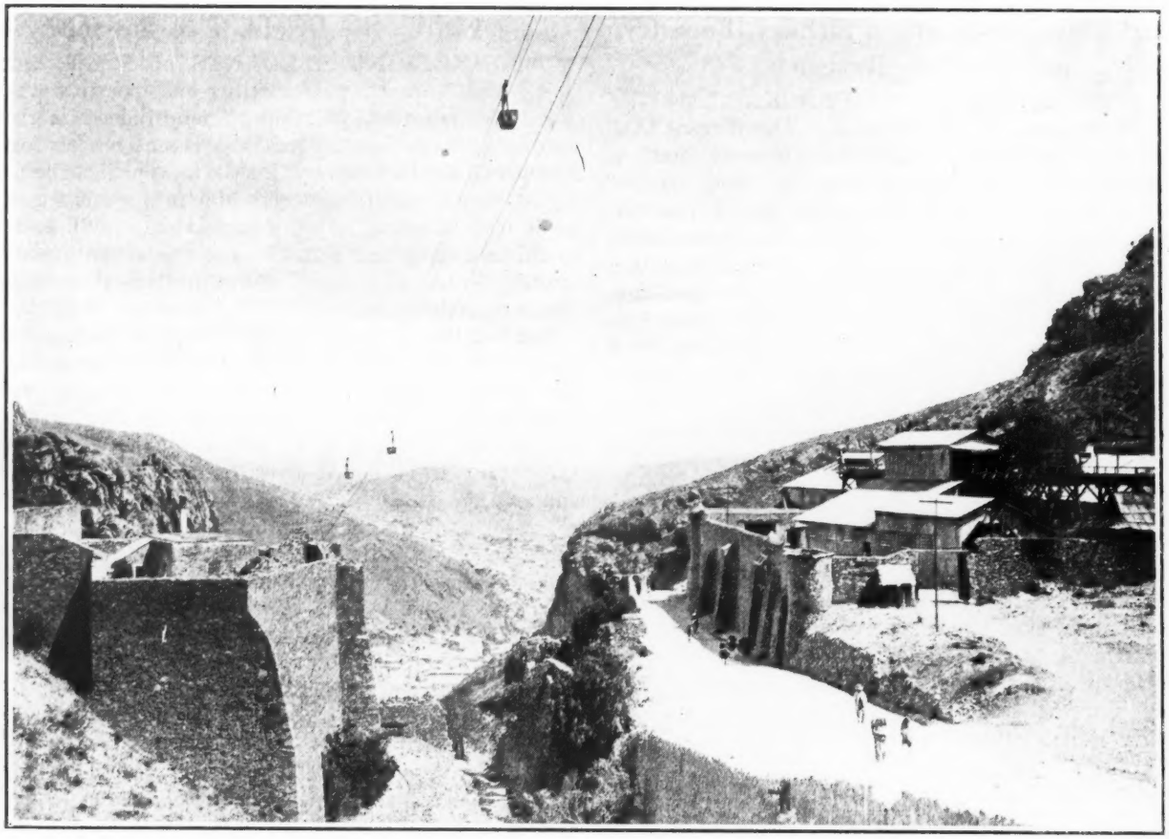
As yet the new organization is headless, but it will doubtless soon be functioning. The movement marks a constructive effort in engineering education. The graduate is truly fortunate today to find someone who takes a practical interest in him upon his debut into technical work. Though the technical world may be his oyster, too often in the past he has found it exceedingly hard to open it. If this has been because he unwisely chose a profession for which he was unsuited, then an advisory organization, such as that now projected, might have saved him from pursuing a mistaken course.

Deep Drilling and Petroleum Exploration

ONE of the significant developments of recent petroleum engineering is the perfecting of methods for drilling deep wells. Although the history of the industry affords a number of examples of deep wells, it is only comparatively recently that deep wells have become an accepted fact and no longer arouse special comment.

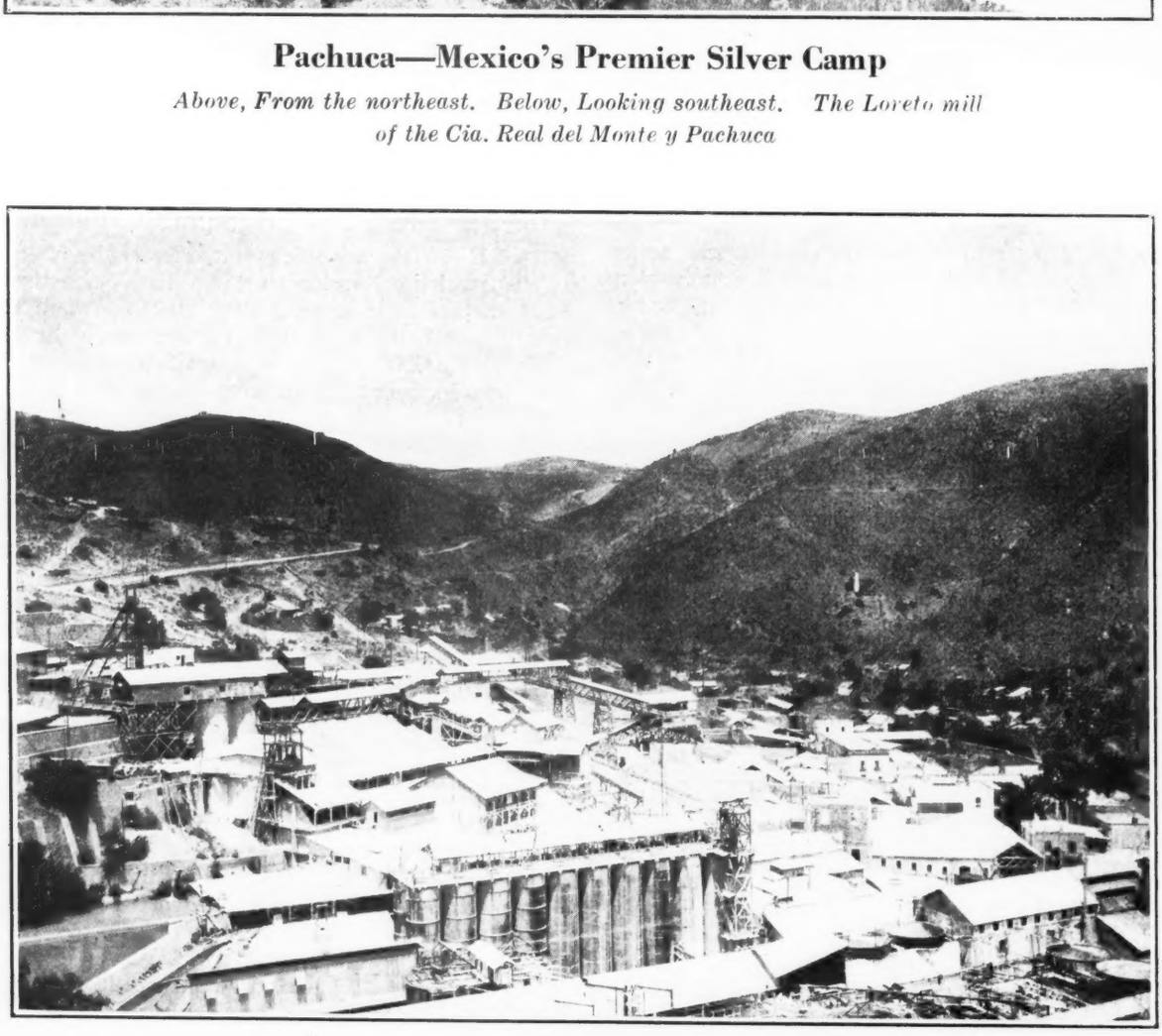
Methods and drilling tools, as well as materials used in their construction, have made great advances, and as a result the petroleum engineer has now extended his depth horizon to 5,000 ft. and even deeper. The *Standard Oil Bulletin* states that there is a hole in Southern California 8,046 ft. in depth and still drilling. This is far below the deepest metal mining. Manufacturer, tool maker, well driller, and engineer have co-operated to bring about these important advances. Without them the discovery of deep oil sands close to Ventura, Calif., would not have been made.

The "new" field, according to the *Standard Oil Bulletin*, has reached a production of 60,000 bbl. per day, all from recent exploitation of deep sands. It was started in 1903 by the discovery of gas in an irrigation ditch. A number of wells were drilled, but none to a depth of over 800 ft. Attempts to drill deeper wells failed in part to obtain commercial production. Early in 1925 a well was drilled to a depth of 5,150 ft. and opened up the new oil sands, which extend from the bottom of the old producing wells at about 4,100 ft. to about 6,850 ft., the deepest producing well in the field.



Pachuca—Mexico's Premier Silver Camp

Above, From the northeast. Below, Looking southeast. The Loreto mill of the Cia. Real del Monte y Pachuca



Shaft Sinking Today at Butte

Improved Method Perfected by Elm Orlu Now Standard for That District

By Howard R. Drullard

District Manager, Denver Rock Drill Manufacturing Co., Salt Lake City, Utah

Howard R. Drullard

THE remarkable accomplishment of A. Guthrie & Co. in advancing an 8 by 9-ft. single heading 1,157 ft. in October, 1926, at the Cascade tunnel, at Scenic, Wash., has again emphasized the great importance of improving the methods of excavating broken rock resulting from underground operations and is indicative of the possibilities of new and improved methods, applicable to work of this nature. To no phase of underground work is the excavation of broken rock more important than in shaft sinking, and it is rather startling to realize that in the long history of mining there has been but one improvement of method, that of mechanical hoisting. The Phœnicians, in sinking circular shafts in what is now England, in the dawn of mining history, shoveled broken rock in the same laborious methods generally employed today. In vertical shafts, shoveling is still universal, but in recent years a method has been developed in the Butte district that considerably reduces the amount of effort required to accomplish this necessary work. The new method, originated by Fred Bacorn and Al Wiggenstein at the Great Butte Copper Co. in 1918, has been improved and perfected by George Roddewig, superintendent of the Elm Orlu Mining Co., so that today it is the accepted system of shaft sinking in the Butte district.

The ultimate is still far from being attained and adaptations from the great field of mechanical equipment present additional possibilities. One of the first thoughts that naturally occurs to the student of shaft sinking is that of the use of orange-peel buckets, and although that has been tried, unsuccessfully, it is my belief that under proper conditions mechanical ingenuity will solve the problems that brought failure to previous efforts, and much shaft sinking will become, therefore, practically a mechanical operation.

The method described in this article may point the way toward the successful adaptation of orange-peel buckets to shaft sinking if the orange-peel bucket be used solely as a digging tool and not as a means of digging and hoisting. In other words, it is my thought that in the future orange-peel buckets will be used to do much of the actual digging in the bottom of a shaft, but instead of hoisting the rock out of the shaft by this method, the bucket will be tripped and its contents discharged into a skip or other suitable device capable of being lowered to the bottom or close to the bottom of the shaft.

The Shaft Sinking Cycle

Shaft construction in hard to medium rocks involves a specific cycle of operations which are repeated a sufficient number of times to reach the desired depth. The cycle includes the following steps: (1) Drilling a round of holes, systematically spaced over the bottom area; (2) placing blasting timbers, charging, tamping, and blasting holes; (3) removing blasted rock, barring and trimming the shaft section; (4) placing shaft sets in position; and (5) clearing the section, attaching drill hose, and bringing drills and drillers to the bottom.

The Elm Orlu shaft, like all Butte shafts, is rectangular in shape. It contains three compartments of standard size and one pump compartment, the timber

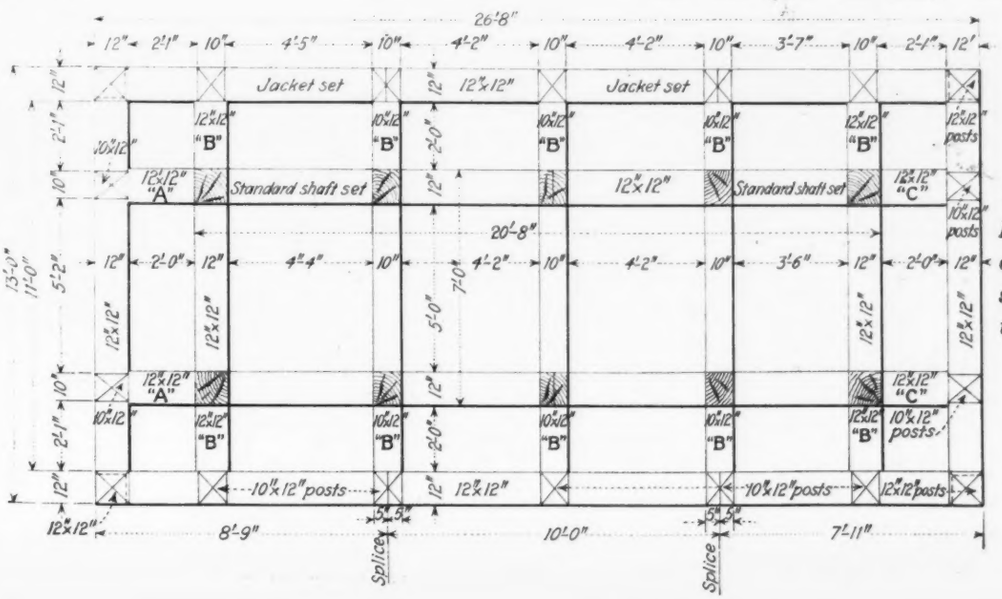
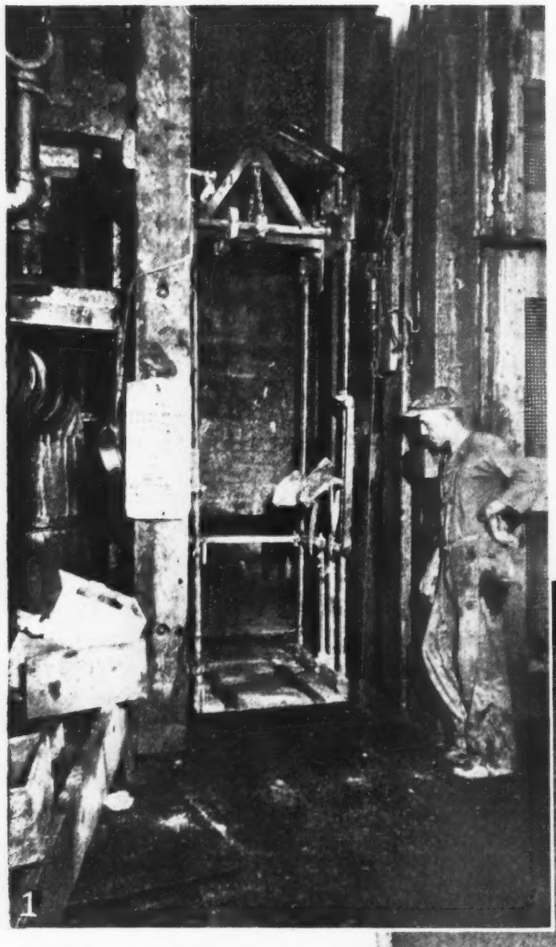
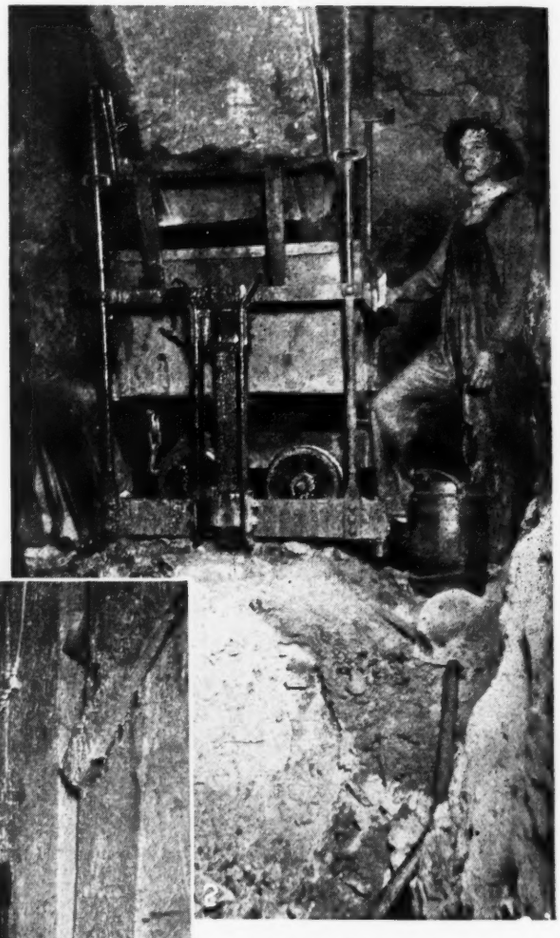


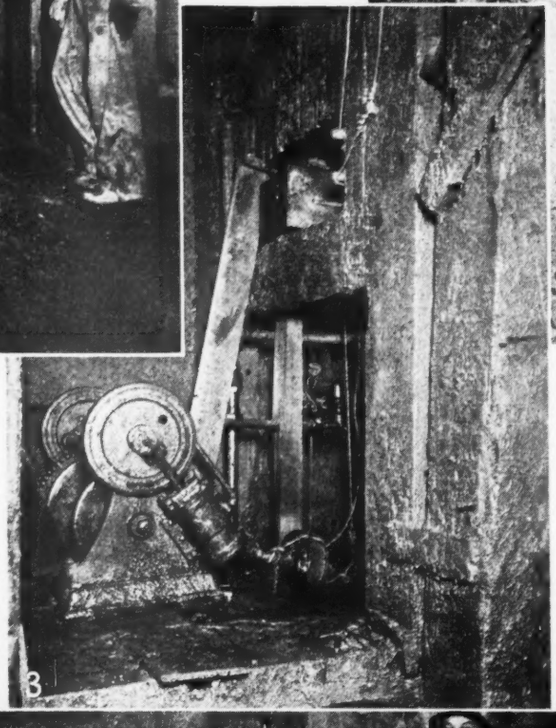
Fig. 1—Sketch showing dimensions of standard shaft set and supplementary jacket set used at Elm Orlu mine



1. Skeleton sinking cage with car removed, at sinking level. Detachable auxiliary lip which prevents spillage in dumping is shown. It is an inclined piece of sheet iron with two sides



2. Bucket dumping, viewed with bottom resting on auxiliary lip. The long links engage the "ears" of the bucket and cause it to assume dumping position on continued hoisting



3. Auxiliary hoist on shaft timbers on a level below sinking level

4. Loading bucket in shaft bottom. Miner has hand on one control rope

measurements being 20 ft. 8 in. by 7 ft. over all. Detail dimensions are given in Fig. 1, which shows not only the standard shaft set but also the supplementary jacket set, which is frequently required after the shaft has been used for a time, the jacket sets being placed when retimbering is necessary. The size and shape of the shaft precludes the working of more than five men in the bottom, and shoveling is by far the longest single operation in the cycle, as is shown in the detailed summary that accompanies this article.

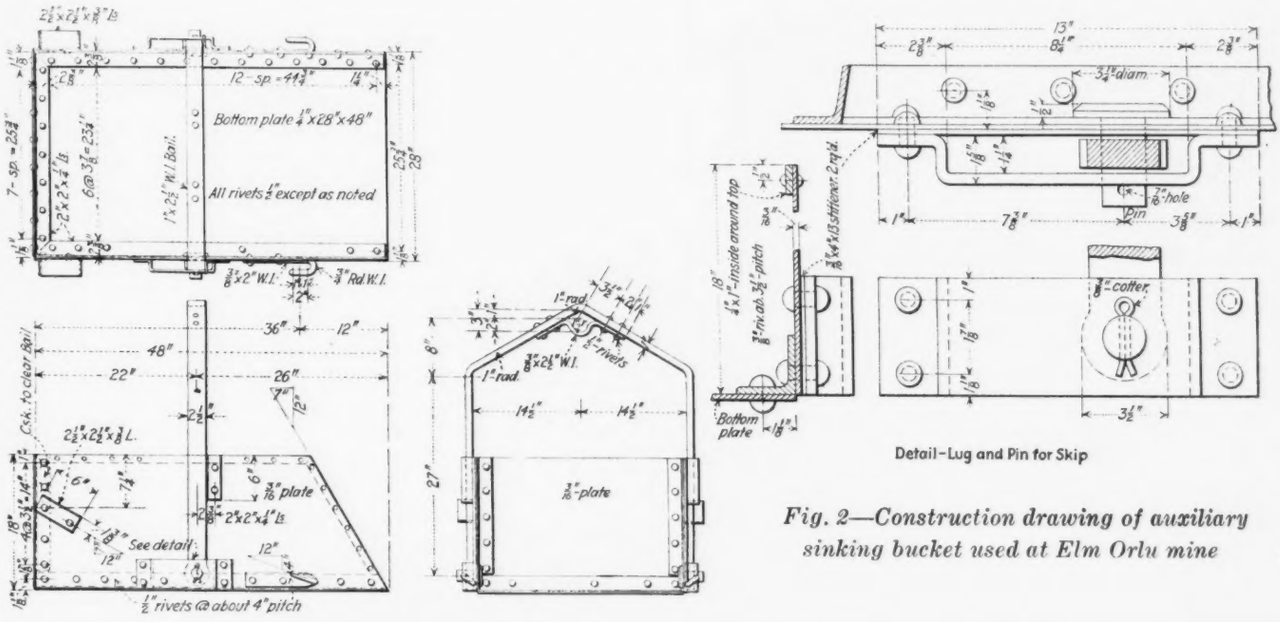


Fig. 2—Construction drawing of auxiliary sinking bucket used at Elm Orlu mine

The method of shaft sinking, as employed at the Elm Orlu mine, differs from the standard shaft-sinking methods in only one primary essential—that is, the method of handling the broken rock in the bottom of the shaft. Ordinarily, in doing this part of the work one or more sinking buckets of a cylindrical type are used. These are attached to the bottom of the sinking cage or directly to the crosshead by means of chains or links. This facilitates the rapid exchange of the loaded bucket for the empty one in the bottom of the shaft. The objections to the use of these sinking buckets are that they are extremely heavy, and require considerable effort to move them about the bottom of the shaft, to position them conveniently for loading. Also, their height is such that the entire material removed from the bottom of the shaft must be shoveled to a height of at least 30 to 36 in. This adds greatly to the fatigue and time required in doing this part of the work. Finally, in the rapid operation of sinking, the sinking bucket is often dragged against the side of the shaft or the wall plates, causing spillage, which greatly increases the danger to the men in the bottom.

The method used at the Elm Orlu mine is portrayed in the sectional view of the shaft and equipment and was developed primarily to overcome the above-named difficulties. It consists of two primary essential pieces of equipment:

First, an elongated sinking cage of special design, which may be operated from a sinking level, upon which the rock from the shaft is either transferred into a skip pocket and hoisted to the surface of an automatic skip or transferred to such points in the mine where the need for waste in the stopes may exist. This sinking cage may be lowered by means of the auxiliary sinking hoist located upon the sinking level, or by a hoist located upon the surface near the collar of the shaft. The cage is shown, in whole or in part, in the accompanying photographs. It has extension guide shoes which permit it to travel about 15 ft. beyond the timbers to the bottom of the shaft. The timbers should be kept close enough to the bottom so that the cage will not pass below the guides. The sinking-cage design must be such that it will carry a standard mine car. It must be of skeleton construction above the height of the car, so that the material handled in the bottom of the shaft may be dumped into the car over its side and through that portion of the cage which is usually occupied by guide shoes. In some of the photographs this skeleton construction is evident and shows plainly the lower guide shoe with a wide flaring mouth at its upper end.

Secondly, an auxiliary loading bucket is used, and handled by means of a small hoist, situated preferably just below the bulkhead of the sinking level, and operated by the sinking crew from the bottom of the shaft, through control ropes. The hoist used to handle this auxiliary bucket may be either an air or electric hoist, the prime essential being that its throttle or controller, as well as the clutch, may be operated by the men in the bottom. To accomplish this with the proper degree of safety it is necessary to operate these control levers through ropes over pulleys, and against counterbalancing weights or springs, so that at any time when tension is not exerted upon the control rope the throttle is in the off position, and when tension is not exerted upon the control rope leading to the clutch lever, the spring or counterbalancing weight will positively keep it in the engaged position. If the hoist is a small one whose lifting capacity is very close to the actual load to be lifted, it may be desirable, in order to obtain increased smoothness in operation and control, to run its hoisting cable through a set of blocks. This is entirely dependent upon the relative size and gear ratio of the hoist and the load to be lifted.

The auxiliary sinking bucket is shown in detail in

Fig. 2 and consists of an open-ended panlike bucket very similar to the body of an ordinary wheel scraper. The one used at the Elm Orlu has a length of 36 in., a width of 29 in., and a height of 18 in. It was purposely constructed of material as light as the service would allow and as low as possible, to lessen the shoveling effort. This pan is swung from a bail near its bottom and approximately at the center in such a manner that when the bucket is loaded the weight is slightly greater upon the closed end, thus holding the bucket in a horizontal position by means of two angle-iron stops which engage the hoist bail. There is also another set of angle-iron stops on the sides of the bucket near the closed end, set at an angle, which function when the bucket is in the dumping position and prevent the body of the bucket from turning over completely. Near the open end of the bucket, attached to the sides near the bottom, are two hooks, one on each side, which function when the bucket is being dumped into the mine car upon the deck of the sinking cage. The bucket is so balanced that when either empty or loaded it rests in a horizontal position when hanging from the bail. This is clearly illustrated in one of the photographs, which shows the bucket partly filled in the bottom of the shaft.

In blasting, the holes upon one end are delayed somewhat, so that a low point is left in the broken rock. The shaft men are then lowered with their tools upon the sinking cage; the blasting logs are removed and the auxiliary loading bucket is attached, through a chain and blocks, to the loading hoist. The loading bucket is placed in the lowest point in the shaft and the broken material raked and shoveled into it. As soon as the loading bucket is filled, it is hoisted to the height of approximately 4 ft. A man stands at each side of the loading bucket, near the open end, which is directed toward the side of the sinking cage (the cage having in the meantime arrived containing an empty mine car). The large links on the bar of the sinking cage (shown in (2) on page 358) are then engaged on the cars or hooks on the side of the auxiliary loading bucket. Almost simultaneously with the engaging of these links, one of the other men in the bottom pulls the rope attached to the throttle of the small hoist, which slowly raises the loading bucket. As the loading bucket is raised, the forward end, being attached to the side of the sinking cage by means of the links, is gradually tipped into a dumping position. As soon as the bucket reaches its dumping position the control rope to the throttle is released and tension is applied upon the control rope leading to the clutch lever. This releases the clutch, and, through the weight of the bucket, the drum unwinds and the bucket descends. When the bucket has reached the desired position the clutch control rope is released. The bucket is then ready for the next loading. The capacity of the bucket is slightly less than that of the car, so that when a completely loaded bucket is dumped into the car the car is never overloaded; therefore there is very little danger from falling rocks while the cage is being hoisted. During the time that the cage is being hoisted, supplied with an empty car, and returned, the auxiliary loading bucket is refilled and ready to be dumped into the car.

In the sinking operations at the Elm Orlu mine the sinking level was kept at such a distance from the bottom of the shaft that the time required to fill the auxiliary loading bucket was practically the same as that required for returning an empty car. It was found that a sinking range of from 400 to 500 ft. below the sinking level worked out with a minimum loss of time on the part of the shovelers. A greater distance caused some loss of time in waiting for the return of the cage.

As soon as the bottom of the shaft is cleared at one point sufficiently to permit the loading bucket to be placed in it, considerable time and effort are saved by the use of small slick sheets, upon which rock is raked and thence shoveled with square point shovels into the loading bucket. In many instances a large portion of the rock is raked directly into the loading bucket, thus avoiding considerable shoveling.

Method Modified to Dump Into Special Skip

A modification of this method where conditions permit is to dump directly into an especially designed sinking skip. The skip is designed with an open side, so

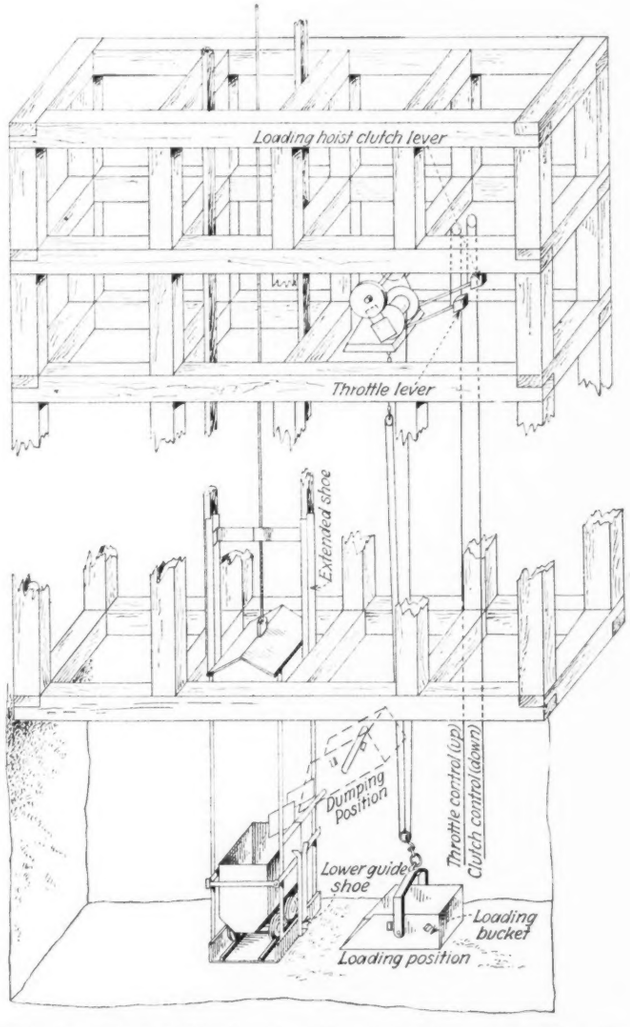


Fig. 3—Sketch illustrating the operation of loading the broken rock and the relative position of the loading hoist in the shaft

that dumping can proceed over the sides, through the position usually occupied by guide shoes. Thus, in a large shaft being sunk at Grass Valley, Calif., by J. Fred Johnson, contractor, two auxiliary loading buckets are used, one from each side, loading into a skip having large capacity and self-dumping facilities.

In the accompanying photographs and in the sketch all details are clearly visible, so that little difficulty should be encountered in applying this method at any other shaft.

BUTTE'S SINKING PRACTICE STANDARDIZED

Sinking operations in Butte have developed a standard practice as to drilling, blasting, and timbering which I have described, under the title of "Shaft Sinking Methods of the Butte District," in *E. & M. J.* of March 20, 1920. The salient points are as follows:

The sinking is done by contract labor at rates varying from $37.50 to $45 per foot, which covers all labor in the bottom. Explosives, tools, hoisting, and all other expenses are borne by the company. The ground varies from an altered Butte granite, drilling at a rate of about 12 in. per minute, to fresh, hard granite that will slow drilling speeds down to about 6 in. per minute.

The drill round varies from thirty to forty holes. Where thirty holes are used they are distributed in ten rows of three holes each across the shaft. Breast, back, and corner holes are usually 6 ft. deep and drilled almost vertical. The cut holes are 10 to 11 ft. deep and are drilled in two opposite rows so as to bottom closely together, for, like all other rounds, best results from the cuts are obtained when opposed cuts are fired simultaneously.

Forty per cent gelatin dynamite, in 1¼ by 6-in. sticks, is the usual explosive, although it would appear that slightly better results might be had by using a 1¼ by 8-in. stick. Electric delay-action exploders detonate the charge, missed holes being rare. This is due to the fact that Butte shaft contractors are specialists and thoroughly trained in the use of electric exploders. Primers are prepared on the surface, the cap being deeply embedded in the cartridge, then securely tied around the top and middle. The lead wires are wound around wooden spools, and the primer, properly numbered, is placed in a primer box, the top section of which is drilled with 1¾-in. holes arranged to correspond with the holes of the shaft round.

The drill holes are blown and charged with powder, and the 14-gage rubber-covered lead wires wound on a spool at the station are played down the shaft and attached to busbars of No. 4 bare copper wire fixed on two cleats nailed to the ends of a piece of 1x4-in. board about 12 ft. long, or to other light material. This arrangement is known locally as a "fiddle," and its purpose is to furnish an arrangement by which the lead wires can be securely attached to the main circuit and the whole kept from under foot. The No. 4 wire is used, not because its conductivity is greater than that of the 14 gage insulated wire used from the station, but, rather, for the reason that, on account of its large size, a secure connection with the lead wires of the exploders can be effected. To insure that two lead wires of each exploder will be connected in multiple, a white tag is attached to one lead and a red tag to the other. After the round has been charged and the lead wires have been connected to the "fiddle," it is a simple matter to inspect the connections and see that all lead wires are in multiple. Firing is done from the station by 110-volt lighting circuit. The blasting switch is placed in a box so arranged that the switch is locked open and can be closed only by the person carrying the blasting-box key.

Shaft-Sinking Record, Elm Orlu Shaft

Nov. 11, 1924, to April 23, 1925.

Started	10.6 ft. below 3,000 level
Stopped	483.5 ft. below 3,000 level
No. of sets	94
No. of contract shifts	2,007½
No. of contract days 2,007½ ÷ 15	133.8
No. of men per shift on contract	5
No. of men per shift on bottom	5
No. of feet sunk by contract	472.9
No. of cars of waste hoisted	19,407
Sticks of powder used (50%)	38,363
Number of holes loaded	2,716
Number of rounds	84
Number of feet drilled	18,784
Hours drilling	587
Hours delay	244
Hours blasting	184
Hours mucking	1,481.5
Hours timbering	569
Rate per foot	$40.00
Rate per day (shaftmen)	$ 5.50
Earned per day (average)	$10.25
Cars of waste per foot	41.03
Cars of waste per set	206.45
Cars of waste per hour mucking	13.10
Cars of waste per shaft (7½ hours)	98.25
Hours timbering per set	6.05
Hours drilling per set	6.24
Hours drilling per round	6.99
Hours mucking per set	15.76
Hours mucking per round	17.63
Feet drilled per round	223.61
Hours blasting per set	1.96
Hours blasting per round	2.19
Feet advance per round	5.63
Feet advance per day	3.53
Feet advance per man-shift	0.236
Sticks of powder per round	456.7
Sticks of powder per foot	81.12
Holes loaded per round	32.33
Holes loaded per foot	5.74
Hours delay per man-shift	0.1215
Hours delay per set	2.59
Contract labor cost	$20,514.00
Contract labor cost per foot	$43.379

Ventilation is provided by a motor-driven blower at the station, the air being conveyed hence through 12 or 16-in. Ventube to the bottom. This is an important factor, as rock temperatures of 108 deg. F. are frequently encountered. However, by the use of a 3- to 5-hp. blower and 16-in. Ventube delivering approximately 3,000 cu.ft. of air at about 2,000 ft. per minute velocity, the working temperature is reduced to about 85 deg. F. with a kata thermometer reading of around 18, despite the fact that the wet- and dry-bulb reading may be about the same.

Three large electric hoists are now being installed in Butte that will permit the sinking of shafts to the 5,000 level, and although rock temperatures will increase, present ventilation technique will make possible the maintenance of satisfactory working temperatures.

No. 7 Cameron sinking pumps, operated by compressed air, are used when required; water ordinarily is not much of a problem in the Butte district. Eductors have not as yet been used. The use of eductors, however, should be practicable for Butte shafts as well as others where conditions are favorable. Eductors, or water-jet lifts, are remarkably simple devices, particularly well suited for handling water containing a considerable percentage of gritty matter and fine rock, and have been used on levee work, the unwatering of cellars, and many other water-lifting jobs. They are made by a number of manufacturers, and in some districts home-made eductors are frequently seen in service. The principle involved is the use of high-pressure water, taken from the shaft column above the station pump and conveyed in ¾-in. or 1-in. pipe to near the bottom timbers, thence to the eductor through pressure hose. High-pressure water discharged through a ventura tube produces a high vacuum. Suitable suction and discharge lines are provided and the water is finally discharged into the station tank. The device is cheap, compact, weighs about 30 or 40 lb., is self-priming, and

so easily moved that the lowest spot in the shaft is readily unwatered. This permits the bottom to be picked down to the solid and helps the drilling operations materially. The static head must be at least four times as great as the discharge head. In other words, 400-ft. head above the station will permit the sinking of 100 ft. of shaft unwatered by this method, provided the discharge is to the station.

Reference to the detail of timbering shown in Fig. 1 will give information about the standard sinking set as well as the supplementary jacket set which is required in many Butte shafts. There is nothing particularly novel in the hanging of the shaft set. When a wall plate is lowered to the bottom, a chain is tied around the center, the free end hooked to the cable of the small hoist, and the plate hoisted to position, where it is held in place by the hanger bolts. This is followed by the second wall plate as before. A deck load of 2 x 12-in. staging accompanies the second load. Dividers and posts follow in their proper order, and after these are placed in position the service of the hoist is again brought into play and the wall plates are pulled snug against the posts. Hanger bolts are tightened, and blocking of the set proceeds. With one man at each corner the operation is rapid.

It is imperative that the men in the bottom be promptly served with the required timber, and every element of the set must be immediately available at the station when needed. Upon this service largely depends the speed with which a set can be completed. If the timbering is, of necessity, carried close to the bottom and one-piece wall plates are used, two centers on one end are left out and 3½-in. jack bars substituted. When the next set is to be hung, the jack bars are removed, thus permitting the introduction of the next wall plates, and the permanent centers replace the jack bars. Blasting logs are fastened to the bottom set by chains equipped with long finger hooks that insure tension on the chains, and work proceeds on the next phase of the cycle.

Spanish Quicksilver Ores Far Richer Than Others

The average tenor of the recovered mercury in the domestic ores treated in 1925 was 0.5 per cent, says J. W. Furness, of the U. S. Bureau of Mines, in his report on the quicksilver industry in 1925. The tenor of the ore treated in Italy during the same year was 0.7 per cent; of that treated in Spain, 6 per cent. A comparison between Spain and the United States shows that in the States it requires twelve times as much material to produce a flask of mercury as it does in Spain. It seems evident that domestic producers of mercury, laboring under the handicap outlined, cannot successfully compete with Spanish production. This conclusion lends weight to the statement made by Ransome, published in U. S. Geological Survey Bulletin 666, in 1919:

"It is doubtful whether there is any wisdom in attempting to foster quicksilver mining by a high import duty whose effect would be to levy a tax on all users of quicksilver for the benefit of a small group of producers, and it is still more doubtful whether the people of the United States would submit to this tax. It has been urged that as quicksilver is essential in warfare the mining of quicksilver should be stimulated by tariff protection. This might be an excellent argument were our quicksilver supplies without limit, but inasmuch as they are in process of exhaustion it is difficult for one who looks at the question impartially to see why the government should hasten the approach of that day when there shall be no more quicksilver ore to mine rather than purchase quicksilver where it can be bought cheaply, store it as an immediately available reserve supply against the next war, which it is hoped may never come, and rely as a final resource upon those mines in which some ore, that would have been taken out under sufficient governmental encouragement, may yet remain to be of service in a great emergency."

Safety Rules for Blasting Hanging Ore in Chutes or Raises*

All blasts in hanging chutes, ore passes, or drawing raises should be fired with electric detonators, for in addition to increasing greatly the safety of the work, it would appear possible to make a saving in the use of explosive, as bombs can be placed to the best advantage when the blasters are not made nervous from handling a charge containing a lighted fuse. The fire hazard is greater when fuse is used for blasting in timbered chutes than if the charges are detonated electrically. Firing bombs by electric detonators reduces the smoke made by blasting. As chute blasting is done during the working shift, the elimination of smoke in the mine atmosphere is important.

The following regulations should be observed:

1. All blasts in "hanging" chutes, ore passes, or drawing raises should be fired by means of electric detonators whenever practicable.

2. When it is not practicable to blast a "hanging" chute electrically, the fuses used for chute blasting should be at least 2½ ft long. When blasting sticks must be spliced, 8-ft. fuse should be used.

3. Everyone should retire to a safe distance while blasting is being done.

4. Chute blasters should keep explosive in a bag provided for that purpose. Detonators should never be placed in the same container as explosives. Blasters should always take the explosive and detonators with them when they go from one drift to another.

5. In blasting a hanging chute, the bombs should be securely fastened to the blasting stick.

6. Chute blasters should not blast more than one chute at a time.

7. Chute blasters should use extreme care in guarding the approaches to the chutes they are about to blast.

8. When chutes or raises are being blasted, warning should be given on the level below by means of bells or other suitable signals.

9. The blasting of chutes on haulage levels should be done by the boss in charge of the train crews, or directly under his supervision. Men on the grizzly levels should be warned before any hanging chutes below them are blasted.

10. Chute blasters should be able to speak English. If a large percentage of the workmen speak a foreign language, the chute blaster should be able to speak that language also.

11. When electric blasting is done from the mine power circuit instead of from blasting batteries, it is important that the current be held in the blasting lines but a fraction of a second; otherwise there is danger from fire due to short-circuiting and overheating of wires in contact with broken timber.

*Reports of Investigations, U. S. Bureau of Mines, serial No. 2790.

Iron Ores of Iron Mountain and Pilot Knob

By J. E. Spurr

THE IRON ORES of Iron Mountain and Pilot Knob, in Missouri, are well known by name to geologists; but the prevailing idea is a little hazy as to their nature and origin. They have been described by various geologists from 1854 to 1912—Whitney, Schmidt, Nason, Kemp, and Crane.[1] The account by the last-named contains a résumé. There are also a few notes by Per Geijer in 1915.[2] I visited these two deposits briefly in April, 1926, in company with H. A. Buehler, Director of the Missouri Bureau of Geology and Mines, and Mr. C. E. Siebenthal, of the United States Geological Survey; and take this occasion to record my observations concerning these highly interesting deposits and the associated geology.

The oldest rocks in this section of Missouri—and indeed for a considerable surrounding area—are granite and so-called porphyry. The porphyry has all the characteristics of a semi-glassy rhyolite or felsite, including a definite horizontal or slightly inclined flow-banding. The granite where seen is medium coarse, uniform in texture and composition, and highly porphyritic. It is the belief of the Missouri geologists that this porphyry and this granite are transitional one into another; and the little I saw does not negative this somewhat extraordinary conclusion. At certain localities it is difficult to determine whether the rock should be called granite or porphyry. Nor does there seem to be evidence of more than one variety of porphyry or of granite; or, if the two are one, of more than one great mass, forming here the Pre-Cambrian basement in the center of the Ozarks. If the two are one, then the granite is the heart of a great mass, of which the rhyolite or porphyry was the upper and more quickly chilled portion. No older rocks are known. Was this siliceous magma a batholith? It is difficult to regard the rhyolite as other than a surface rock, but it did not show individual members, so far as I saw it. And it may be that the rhyolite was simply the upper margin of a great batholith, the cover of which has been destroyed, and that the flow-structure was due to friction against the invaded cover. For such a subsurface structure of rhyolite, simulating surface conditions, I refer to my study of a great intrusive rhyolite mass at Tonopah, in Nevada, which came up toward the surface at a flat angle, and for many hundreds of feet in its upper part was a mainly glassy rock which showed not only flow structure parallel to the upper contact, but underwent repeated brecciation, so as to simulate a surface volcanic breccia.[3] The reason why the hematite dikes show crystallization at a high temperature, and the inclosing rhyolite at a low temperature at certainly as great a depth, is found in the fact that a high temperature for an ore magma is a low temperature for a siliceous rock magma, these magmas congealing around perhaps 600-700 deg., as contrasted with the provisional 550 deg. assigned the hematite dikes.[4] This granitic rock has a far wider distribution than its exposures in Missouri indicate. Gould has shown[5] that granite underlies the Paleozoic sediments throughout Kansas and adjoining states. In the granite seen in Missouri there is a general uniformity, and no signs of even the beginning of segregation due to magmation. It was not, therefore, a deep-seated granite.

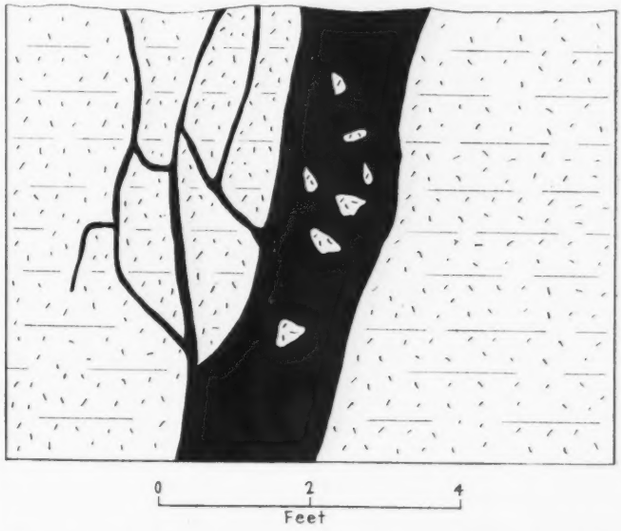


Fig. 1—Sketch of hematite veindike at Iron Mountain, Mo., in Pre-Cambrian felsite with nearly horizontal flow structure. Veindike contains felsite inclusions, and large apatite crystals. By J. E. Spurr

Original Ore Deposits Clean-cut Intrusive Veindikes

At Iron Mountain the original ore deposits consist of clean-cut intrusive veindikes of specular iron in the Pre-Cambrian porphyry (rhyolite or felsite), which occurs with nearly horizontal parting or flow-structure and is of uniform texture. The hematite (specular iron) is well and often coarsely though variably crystallized, the crystals being up to one or two inches long. The contacts with the felsite are sharp, and there is little wall-rock alteration; fresh-appearing feldspar phenocrysts in the felsite occur right up to the specularite contact. Apparently the ore magma was essentially a fluid iron oxide, or the components thereof, and was not to a predominating degree gaseous (aqueous or otherwise). Angular or rounded fragments of the felsite occur isolated in the specularite (Fig. 1). Besides the specularite, there is a little contemporaneous tremolite and apatite. The veindikes are branching. Inconspicuous later small quartz veindikelets cut the porphyry and the specularite veindikes, and inclose isolated fragments of specularite. The main orebody had the shape of an inverted "u," or more like a brad, with a flat top and vertical limbs, each some 20 to 30 ft. thick. Since it was plainly intrusive, it may be defined as two dikes meeting above and joining along the flat parting

[1] "Iron Ores of Missouri." Missouri Bureau of Mines, Vol. X, 2d series, 1912, pp. 107-145.

[2] *Economic Geology*, Vol. X, No. 4, June, 1925, pp. 324-327.

[3] *Economic Geology*, Vol. X, No. 8, Dec., 1915, pp. 745-750.

[4] J. E. Spurr. Bull. Geol. Soc. Am., Vol. 36, No. 3, Sept., 1925, p. 564.

[5] Bull. Geol. Soc. Am., Vol. 34, pp. 541-560, Sept., 1923.

planes (flow-planes) of the felsite, as a sill. The width of these veindikes was some 20 to 30 ft. The underground workings encountered a dike or dikes of dense greenstone (diabase), which cut and was later than the ore.

In the above account of the Iron Mountain primary ores as an intrusive fluid iron magma, I find on investigating the literature that I am in accord with the earliest, Whitney (1854) and Per Geijer, the latest (1915) to write on the subject. Crane (1912) was of the opinion that the ores were "in part fissure filling, but more largely a replacement of the porphyry.[6] Geijer, however, writes: "While proofs of replacement in small details are abundant, the dikes and veins, particularly the larger ones, have all appearance of being fissure fillings. In Lapland we have few examples of a replacement of wall rock by ore, but some cases where amphibole appears in this way. The same may possibly be the case at Iron Mountain." It is interesting that Geijer found the Iron Mountain veindikes almost precisely the same as at Tuolluvaara, in Lapland: "In both cases there appear some larger dike-shaped masses, and a system of smaller dikes and veins." These Lapland deposits are regarded by Geijer as "products of magmatic crystallization," by which he means "crystallization in a liquid solution or melt at some temperature higher than the lowest crystallization temperature of a granite pegmatite—about 550 deg. . . . The evidence of the supposed high temperature is found in the mineral composition—magnetite, apatite, and some diopsidic augite. . . . Specular hematite fills fissures." I note with great interest that the author once employs the term "ore magma" (p. 322). These Lapland ores represent the part of the rock magma which was last to crystallize: in the rocks associated with the ores, the crystallization of the magnetite took place *after* that of the feldspar.

Temperature Range Estimates in Agreement

As regards the temperature of the veindike crystallization, it is interesting to note that a study of the paragenesis of British ores by Finlayson,[7] which divides ores into three successive groups (the tin-tungsten phase, the copper phase, and the lead-zinc phase), finds the general succession in the tin-tungsten phase to be: 1, apatite; 2, magnetite; 3, cassiterite and tourmaline; 4, wolframite; 5, arsenopyrite, scheelite, fluorspar. But in the tin veins of Saxony, Beck gives apatite as later than wolframite, cassiterite, and arsenopyrite. Taking all these things together, a tentative temperature of around 550 deg. for the crystallization of the Iron Mountain veindikes may be assigned[8]: or near or quite at the uppermost temperature of ore magmas (pegmatore magmas). This again, is in agreement with Geijer, who concludes for the Iron Mountain ore that "the temperature has been higher than in most mineral veins, and at least approached the magmatic range. Whether it has actually been above the 550 deg. limit, or a little below, does not constitute any important difference." The occurrence of the diabase dikes *later* than the ore dikes (veindikes) corresponds with what I have found to be a very common occurrence, suggesting that these dikes cooled at a similar or slightly lower temperature.[9]

The horizontally banded felsite which is the wall rock of the Iron Mountain ores has a fine rhyolitic texture; but the well-developed crystallization of the hematite veindikes testifies to slow cooling at the temperature above indicated. Therefore these veindikes cooled at a considerable depth, and have been revealed by subsequent deep erosion. They were not derived from the porphyry, nor from the presumably underlying granite phase. The porphyry and granite of the whole region shows no signs of magmatic differentiation, such as would give rise to special phases: the hematite veindikes, like the later greenstone dikes, came from below all the porphyry-granite horizons exposed, and from a deep source, the nature of which we can only conjecture. A little cobalt and nickel, reported in the Iron Mountain ore, suggests the derivation from a basic magma layer which underlay the siliceous (granitic) layer, and suggests a kinship with the source of the probably late Cretaceous-early Tertiary ores of this southeastern Missouri region, which are marked by some cobalt and nickel, and which occur only some 15 to 20 miles easterly from this Pre-Cambrian iron region. The included minerals, tremolite (calcium-magnesium silicate) and apatite (calcium phosphate), indicate a calcic ore magma. But the later quartz veinlets represent a corresponding siliceous ore magma.

There is also, some 12 miles southeast of Pilot Knob, between it and Fredericktown, a Pre-Cambrian quartz vein which may equally well represent this complementary siliceous ore magma. Here in a moderately grained granite is a veindike of typical magmatic quartz, containing considerable mica, and bunched aggregations of pyrite, galena, and wolframite. The galena was argentiferous, carrying, it is reported 40 oz. per ton—hence the locality is called "silver mine," though during the Great War the vein was worked for tungsten. The galena and wolframite are largely contemporaneous with the quartz, but there is some rift crystallization. There is some fluorite. The vein runs east-west, and is persistent—the average width is about three feet. A trap dike or dikes similar to those at Iron Mountain occur here, but trend diagonally to the vein. The relative age is not exposed.

Siliceous Magmas Congealed at 600 to 700 Degrees

The reason why the hematite veindikes show crystallization at a high temperature, and the inclosing rhyolite shows cooling at a low temperature at certainly as great a depth, is found in the fact that a high temperature for ore magma is a low temperature for a siliceous rock magma, these siliceous magmas congealing around perhaps 600 to 700 deg, as contrasted with the provisional 550 deg. assigned above to the hematite veindikes.[10] The greenstone dikes, which are later than the ore, are fine grained, showing quick chilling, and therefore a wall-rock temperature which may be placed, according to my table, around 500 deg. As all these—porphyry, iron, greenstone (basalt)—are evidently part of a magmatic sequence, the iron ores must have been injected immediately after the consolidation of the siliceous igneous rocks.

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[6] *Op. cit.*, p. 139.

[7] *Economic Geology*, Vol. V, No. 8, Dec., 1910, p. 719.

[8] "The Ore Magmas" (Spurr), p. 263; also J. E. Spurr, Bull. Geol. Soc. Am., Sept. 30, 1924, Vol. 36, p. 564.

[9] J. E. Spurr. "Basic Dike Injections in Magmatic Vein Sequences." Bull. Geol. Soc. Am., 1924, Vol. 36, pp. 545-582.

[10] J. E. Spurr: Bull. Geol. Soc. Am., Vol. 36, No. 3, Sept., 1925, p. 564.

The first existing record of the subsequent deep erosion is found by transferring our attention to Pilot Knob, which lies 6 miles due south of Iron Mountain. Here are Pre-Cambrian sediments, lying conformably upon the porphyry (felsite) from whose erosion they were derived, although both felsites and sediments are tilted so they have a dip to the south of around 18 deg. The underlying felsite is like that at Iron Mountain.

It is overlain, at the top of Pilot Knob, by the sediments: First comes a basal conglomerate six inches thick, of porphyry and iron, which I take to be iron sand; next above comes about 20 ft. of solid shaly hematite, showing ripple marks, mud cracks, and rain prints—evidently, therefore, a beach deposit. This is the main horizon which at Pilot Knob has been mined as ore. Above this comes some 20 ft. of poorer iron ore, containing porphyry fragments, but finely stratified; and above this, with the top removed by erosion, a remaining thickness of some 50 to 60 ft. of rudely stratified poor iron ore, with a principally iron matrix containing angular and subangular and rounded fragments of porphyry and some of granular hematite (Fig. 2).

A "Black-Sand" Beach Deposit

This iron ore seems to me clearly a beach deposit, like the "black-sand" beach deposits now known along existing beaches in various places, as on the shores of Oregon, Colombia, and Japan. Only in Japan, I believe, have they been commercially worked as iron ores; although I tested out such a deposit on the shore of Colombia, with a view to commercial working. The iron in these beach "black sands" is of course detrital—worn from the shore rocks, and concentrated along the beach by the surf, in favorable places. Specular iron and magnetite are minerals resistant to decomposition, and may accumulate thus.[11]

This explanation does not agree with that of Crane, who has studied the deposits carefully, while I visited them hastily; nor indeed with any of the other geologists who have written concerning it, except Nason[12]; so that the reader is asked to take this into consideration. Crane gives five points indicating that the ore is due to "more or less complete replacement and infiltration of stratified tufaceous beds by iron oxide" and is not an original deposit: (1) The ore beds grade both along the strike and dip into "ferruginous porphyry breccia." (2) Thin sections show the partial replacement of porphyry materials by iron oxide. (3) The ore has the same structures and textures as the "tufaceous materials." (4) Small crystals of hematite line cavities and joints in the porphyry "breccias," indicating deposition from solution. (5) The ore in the "breccias" is confined very largely to the matrix.

I regard all these as compatible with the belief that these are iron beach sands. Point No. 1 is a characistic, of course, of beach sands—they disappear laterally along the beach, and also seaward. As for (3), the sedimentary origin implies that iron detritus and porphyry detritus should form sediments with the same textures. As for (2) and (4), some solution and redeposition of iron involving a little replacement would naturally have taken place since Pre-Cambrian times, in a mixed iron sand-porphyry sediment. The marvel is that there has been so little change. In the sedimentary Lake Superior iron area, the transportation and migration of iron has been immense in comparison, for reasons into which I will not here inquire. As for the "breccias," I regard them as sedimentary; they contain many rounded and subangular pebbles, of which some are of iron ore. The

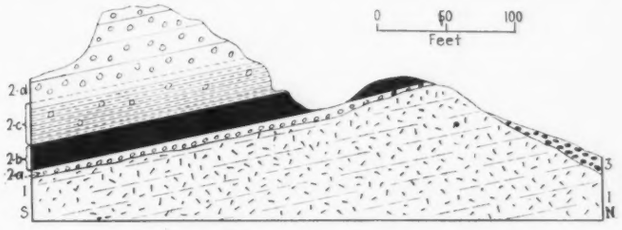


Fig. 2—Rough sketch of top of Pilot Knob, Mo., looking west. By J. E. Spurr

1, Pre-Cambrian felsite (porphyry); 2, Pre-Cambrian sediments, derived from 1; 2a, basal conglomerate six inches, felsite, and iron sand; 2b, finely stratified ripple-marked hematite. Principal ore bed, 20 ft.; 2c, poorer iron ore, with porphyry fragments, but finely stratified; 2d, rudely stratified poor iron ore, angular and subangular and rounded fragments of porphyry and some hematite, matrix mainly of iron; 3, Pre-Cambrian hillside manta or talus deposit, derived from erosion of 2, and running down north side of mountain, under Cambrian strata.

whole gives to me the picture of initial leisurely sedimentation on a beach where the only shore rock was the felsite (which, indeed, appears to have been the only surface rock mass existing at that time), changing to a rapid accumulation of partly worn and poorly assorted land-derived débris. As to the origin of the detrital iron, this explanation assumes the existence of ore veins in the porphyry, in the hills which towered above this ancient shore, and which have been entirely removed by erosion. Crane records that on the northwest side of Pilot Knob (opposite these sedimentary iron beds) small vertical veins of hematite were encountered: "The ore, which is massive, resembles in texture and manner of occurrence more nearly that of Iron Mountain than the associated deposits of the iron-bearing formation at Pilot Knob."[13]

Among the evidence which Crane cites that the beds are pyroclastic rather than sedimentary is that "the bedding of the ore is conformable to the flow-bedding in the underlying porphyry breccia with no intervening conglomerate." My observation, to repeat, is that the immediately underlying porphyry is not a breccia; and that an inconspicuous but definite conglomerate separates the ore beds from the porphyry below. Moreover, while Crane states that the porphyry "breccia" overlying the ore beds contained no pebbles of iron, I found such pebbles. Crane recognizes ripple marks both in the basal ore bed and in the overlying poorer ore bed, and notes a "gradual and irregular upward transition" into the "ferruginous porphyry breccia."[14] Also, he remarks that the porphyry "foot wall" of the ore, where exposed, is "often very irregular."[15]

Effect of Cataclysmic Uplift

These Pre-Cambrian shore-line sediments were afterward elevated into mountains, by a further uplift of the porphyry-granite land mass, and towering mountains were carved out by subsequent erosion. Erosion attacked the bedded beach sands of Pilot Knob, and the hematite veindikes of Iron Mountain as well. Detached

[11] J. E. Spurr: "Geology Applied to Mining," 2nd ed., 1926, p. 274.
[12] Missouri Geological Survey, Vol. 2, 1892, pp. 50-65.
[13] Crane. *Op. cit.*, p. 129.
[14] *Op. cit.*, p. 126.
[15] *Op. cit.*, p. 123.

boulders of iron ore rolled down the mountain sides and, more resistant to disintegration than the accompanying porphyry, accumulated in mantles of débris, steep-lying as talus, especially in the furrows or gullies on the mountain sides—great boulders which had not traveled far, or been water-worn.

Mountain Dropped to Ocean Depths

Then the most extraordinary thing happened of which I have seen trace in the geological record. The mountains, with their iron-ore talus on their sides, were dropped suddenly to the depths of the ocean. There was evidently no gradual sinking, with attendant shoreline erosion and sedimentation; there is no trace of that. The subsidence must have been in the nature of collapse, a very foundering of the great island or little continent; and towering mountains found themselves, without a transition period, beneath the sea. When I examined the geological maps and cross-sections of Missouri geology, and noticed that beds of many geological horizons, from the basal Cambrian up through the Ordovician, and even perhaps the Carboniferous, were represented as all abutting against a single steep granite contact, I suspected that the granite was intrusive, not underlying (Fig. 3). My sketch (Fig. 4) of the side of an open cut at Iron Mountain shows the unique situation.[16] The old mountain side was steep—22 to 23 deg.—and the great boulders of hematite which have formed the subject of mining operations do not represent a conglomerate, but a residual slide or manta deposit from outcropping hematite veindikes far higher than the one now mined and whose top was exposed in mining. Against this steep submerged mountain side, the sketch shows the basal La Motte Cambrian sandstone and the overlying Bonne Terre limestone deposited with no shore line facies—apparently, therefore, in deep water, remote from land. The subsidence of the mountain was so sudden that even the mountain-side débris was not worked over and incorporated in the Cambrian sediments—hence this hematite talus must have been most suddenly transported from a mountain side to an undersea situation free.from currents. Crane well describes this manta ore as consisting "of angular to subangular boulders and pebbles of specular hematite in hard gray arkose. . . . In places the ore was found to consist exclusively of angular boulders of hard blue hematite. . . . The general angular nature of boulders . . . indicate that the conglomerate ore is more largely the result of Pre-Cambrian surface disintegration than of shore action during Cambrian time."[17] This ore is

[16] This corresponds with the descriptions and sections of Crane.
[17] *Op. cit.*, p. 112.

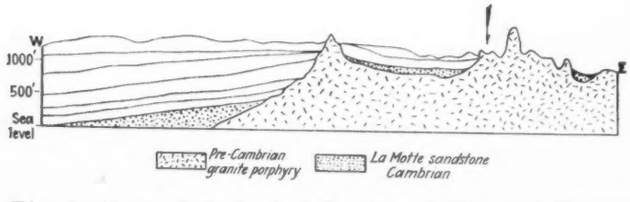


Fig. 3—Part of Geological Section of Missouri Bureau of Geology and Mines, 1922, passing through Iron Mountain-Pilot Knob (indicated by arrow) section. Vertical scale exaggerated in comparison to horizontal scale. On the left the successive sedimentary formations go up as far as the St. Peter sandstone (Ordovician)

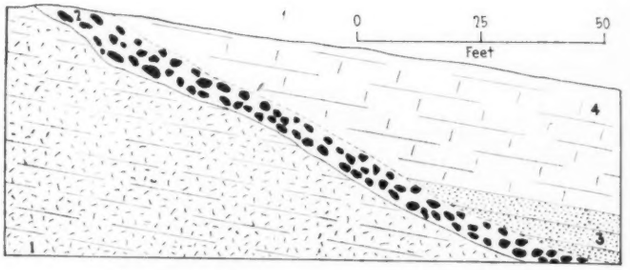


Fig. 4—Sketch of side of open cut at Iron Mountain, Missouri. By J. E. Spurr

1, Pre-Cambrian felsite, with flow structure; 2, Pre-Cambrian talus or manta of hematite boulders; 3, La Motte sandstone, basal member of the Cambrian series; 4, Bonne Terre dolomite (Cambrian). Neither of the Cambrian sediments show shoreline facies. The Pre-Cambrian hematite manta deposit has been the basis of mining.

confined chiefly to ravine-like depressions in the surface of the porphyry.

The same conditions existed at this period at Pilot Knob, where the Pre-Cambrian hillside iron manta deposit (3, Fig. 2) was derived largely from the early stratified iron beach sands above described, and hence have been less resistant to weathering than the similar deposits of Iron Mountain. They have, however, been the subject of considerable mining in both places, and aggregate a large tonnage.

This region—the Ozark region—after many ups and downs emerged finally from the Paleozoic sea, after the close of the Carboniferous, for patches of Carboniferous rocks are found close to the granite areas. Subsequent erosion has stripped off the sedimentaries and exposed the Pre-Cambrian granite-porphyry mountains. Since that period, erosion has been active in reducing the granitic eminences, and in consequence on Iron Mountain the more resistant hematite ore accumulated on the surface as a manta, precisely as it did on the Pre-Cambrian mountains.

Entire Mountain Covered with Manta Iron

Thus we have, let us say, a Tertiary manta in the same locality where we have a similar Pre-Cambrian manta; and both have been mined as sources of commercial ore. Before mining began, the surface of Iron Mountain was so entirely covered with this Tertiary-Quaternary "float" or manta iron that it was supposed that the whole mountain was of iron—hence its name. Since the primary veindikes of the mountain constitute a very small part of its volume, this Tertiary (and earlier) lowering of the original Pre-Cambrian mountains must have been very great. The Pre-Cambrian manta was similarly extensive, denoting equally a very long period of erosion. Similar Tertiary (and earlier) manta deposits occur on and around Pilot Knob.

Summing up, we have, in Iron Mountain and Pilot Knob, Pre-Cambrian hematite veindikes, from which have been derived three distinct sets of detrital deposits: a Pre-Cambrian beach sand (Pilot Knob); a much later, but still Pre-Cambrian, talus or manta deposit; and a Post-Carboniferous (probably largely Tertiary-Quaternary) manta deposit.

There are lesser exposures of the iron ores in this area, described by Crane, which I did not visit. Shepherd Mountain shows fissure veins of ore, and the Tertiary-Quaternary manta ore. The fissure veins, besides hematite, contain some magnetite and pyrite.

Novel Improvements in Electric Equipment in Lake Superior District

Operating Conditions Call for Unusual Sturdiness—Use of D. C. Shovels Increasing—Automatic Power Control of Ore Cars on Stockpiles and in Pits

By Edgar Gealy
Assistant Editor

MINING in the Lake Superior region presents a great variety of problems for electrical and mechanical engineers. In some places the ore deposits lie close to the surface and require a method of mining which necessitates the use of special apparatus, whereas in other areas the ore must be mined from great depths underground and requires an entirely different system of mining and other types of machinery. In still other parts of this region sands must be dredged, and apparatus not used in either open-strip or underground work must be employed. Yet the work of modernizing these operations is rapidly progressing; in fact, it is quite probable that the present year will be an outstanding one in the application of those kinds of machinery which will work more quickly and safely and more economically than the older types that are replaced. Lately some of the larger companies in this field have planned to purchase many large shovels and other electrical and mechanical machines. This indicates a definite trend toward complete modernization by the use of apparatus which embodies features of higher efficiency, greater safety, and automatic control.

One of the most important factors influencing the selection of equipment for use in this field is the cold weather. Ore shipments on the lake can be made during only six months of the year. Consequently, the operating service of nearly all equipment is unusually severe during the busy season. Owing to the limited amount of time to get ore out of the stripping operations, breakdowns and delays must be eliminated.

The necessity for rapid development is another important problem, especially where taxes are continually being unreasonably increased. The old idea that ore in the ground is the same as money in the bank no longer exists. It is fully recognized today that the longer it takes to work an orebody, the more it costs. Labor conditions change, wage scales advance, and equipment and repair parts required increase with extensions of time.

The superiority of electric drives is well recognized throughout the field, and although all types of machines are not electrified, this is primarily because there is always a desire to be certain that anything new will surely withstand the severe service to which it is applied. There are definite indications of rapid progress in the use of electrically operated stripping shovels, underground loading machines, material transporting devices, and pumping and air-compressor drives; as well as other equipment.

In analyzing the advantages of electric shovels one company in this field has found that even when allowing no salvage value for the steam shovel that is replaced, an electric shovel effects savings which more than pay for itself in two years. Furthermore, labor, repairs, and supplies are each reduced to one-third that experienced with steam shovels. Here again the question of sturdy design is important; for if anything has held back the application of electric shovels it has been a feeling that they should be built stronger.

A trip through the Lake Superior mining field at this time of the year reveals many interesting developments already worked out or being tried. A novel

Fig. 1—This automatic telephone switchboard at the operation of the Montreal Mining Co. includes a code signal system and a watchman's station recording device, conveniently combined

Fig. 3—The ore hoist at Montreal, Mich., is now driven by an induction motor, but the bedplate, as shown, is designed for a large direct-current motor when larger tonnages will be mined

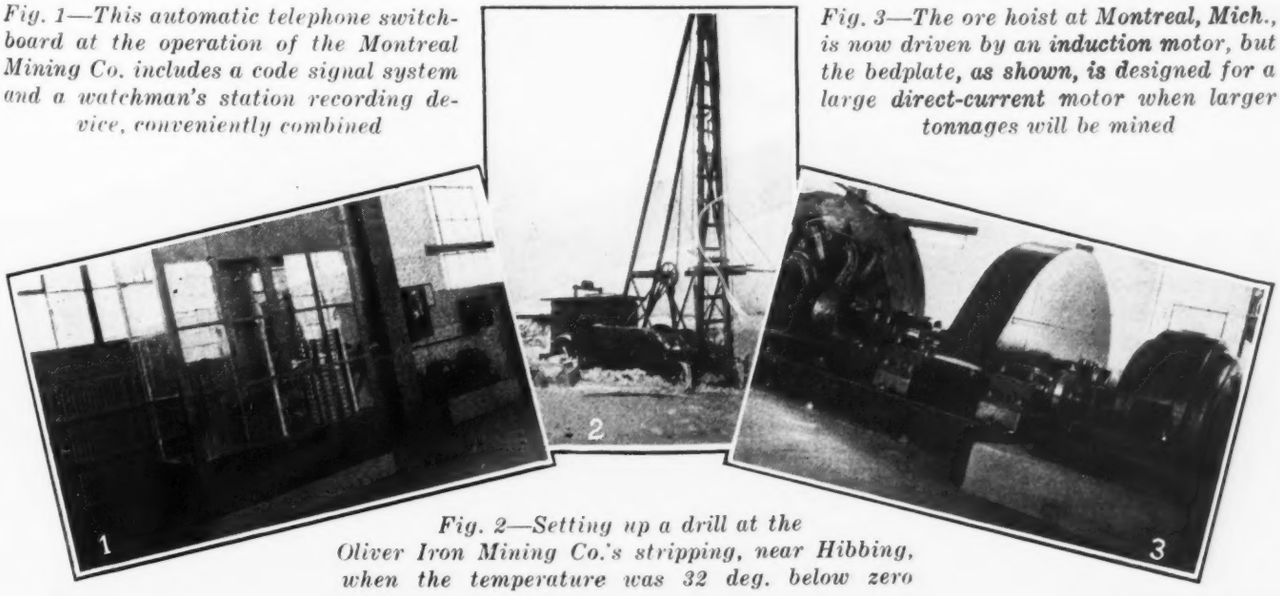


Fig. 2—Setting up a drill at the Oliver Iron Mining Co.'s stripping, near Hibbing, when the temperature was 32 deg. below zero

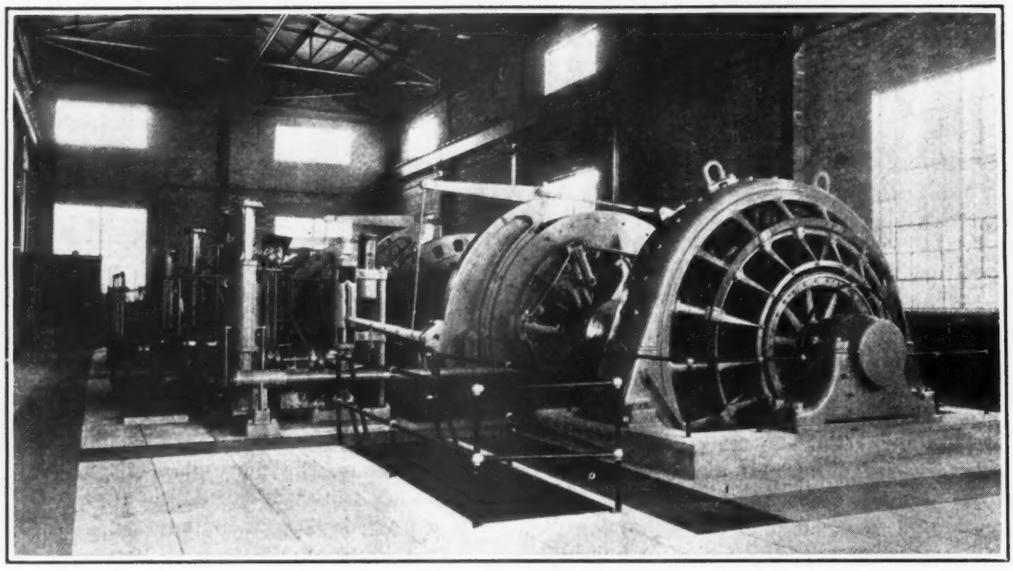


Fig. 4—At the Bessemer mine of the Corrigan, McKinney Steel Co. these two hoists handle men and ore. The ore hoist is driven by a 1,650-hp. direct-current motor and the man hoist by a 400-hp. induction motor. Each has several special safety features and power control systems of interest

method of controlling the movement of cars to and from stripping shovels is employed by the Pickands, Mather Co. This system is the Woodford electrical method of handling cars. By means of remote-control equipment, operators in towers at various points along the haulage system, between the shovels and dumps, cause the cars to move to and from both the shovels and dumps.

The M. A. Hanna Co., pioneers in the use of electric stripping shovels, has contributed much to the perfection of electric equipment used in open pits. This company has been able to effect large savings, which have meant much to the successful mining of ores which present big material-handling problems. Its experience has also definitely established a place for storage-battery locomotives on strippings. Another problem solved by the M. A. Hanna company is that concerning the protection of large electric cables from breakdowns due to corona discharges. The copper-wire sheathing early adopted by this company for its cables supplying energy to shovels is now used by manufacturers of electric conductors for electric shovels.

The Oglebay Norton Co., at its Montreal mine, near Ironwood, Mich., has one of the finest plants in this district. Two large duplicate ore and supply hoists, each equipped with a 600-hp. motor, operate the shaft cages. One of these outfits is designed to use a larger direct-current Ward-Leonard controlled hoist motor at a later date when mining conditions warrant the change.

A most interesting automatic telephone system is installed at the Oglebay Norton plant. It includes a call signal and watchman's recording system. Signal horns located both inside the mines and in the various buildings on the surface can be used to call any desired person by dialing the automatic telephone switchboard and setting the proper calling code in operation. Certain of the telephones around the plant are also connected to a recording device so that the watchman records his visits by dialing from these phones and "reporting" his time and station to the recording device.

A saving of as much as $92 per month is simply and easily made at the Ironton mines of the Corrigan, McKinney Steel Co. by shutting down the large Ilgner-Ward-Leonard motor-generator set after a predetermined delay has occurred to the hoisting equipment. This hoist is a 1,650-hp. unit operating to a depth of 2,500 ft., and by stopping the draught of power to float

Fig. 5—Sixty-four 40-hp., 440-volt induction motors drive the same number of grinding mills in this single aisle in one of the plants of the Calumet & Hecla Consolidated Mining Co. at Lake Linden. No other type of drive could be so well arranged to economize space and facilitate upkeep of this equipment

the motor-generator set during long idle periods the above-noted power saving is accomplished.

The remotely controlled haulage devices used on the dump cars running from the shaft to the storage piles at the Ironton mines are a distinct contribution toward automatic operation of such transportation systems. One man in a tower controls the complete trip of a loaded car from the shaft loading bins, over the trestling to the dumping point and back to the loading bins. Motors and contactors on each car respond to the applications and variations of power transmitted to them over the trolley system through which they are supplied.

The large power-generating system, consisting primarily of hydro-electric plants, owned by the Cleveland-Cliffs Iron Co., around Ishpeming, has lately been separately incorporated into a company by itself. In building up this power system the officials of the company have had opportunities to make many important studies. As a result, the mining company has several large hoists, but only one of them is equipped with a direct-current drive, because it is believed that large power systems can easily withstand peak loads occasioned by 1,000-hp. induction motor hoists, thus obviating the necessity for elaborate direct-current motor and control equipment.

Incidentally, the pumping load of the Cleveland-Cliffs company is larger than that for any other single purpose. Pumps consume one-third the total energy used.

Many interesting safety features are found upon the properties of the last-named company. The headframes are heavily built; herringbone gears are used on pumps and hoists which ordinarily are supplied with spur gears. It is also a general practice of the company to use hoisting drums not fitted with clutches, the feeling being that winding apparatus designed for balanced operation and equipped with a clutch is often strained and made dangerous by being run unbalanced and unclutched.

As far back as 1911 the Cleveland-Cliffs company used synchronous motors to drive pumping machines. Consistent with its policy to be up to date, the company will no doubt soon be devoting much of its efforts to applying automatic, later types of control and protective equipment to replace much of that which it used years ago, when every installation of electrical equipment was a pioneering venture.

The extent to which electrical progress has aided the development of the copper country is exemplified at the Calumet & Hecla plant at Lake Linden. Here large electrically operated dredges, all the year around, raise copper-bearing sand from the lake and deliver it to the mill, where electric-driven preparation apparatus reclaims the copper.

Large electric turbines at this plant are tied into an unusual operating system supplying or using process steam. In one power plant 7,500- and 10,000-kw. mixed-pressure turbines use 180-lb. steam direct from the boilers and low-pressure steam at 1½ lb. from the steam-operated stamp mills. In another part of the mill a 1,250-kw. turbine, lately installed, uses 180-lb. boiler steam and exhausts at 20 lb. pressure to supply steam for the stills in the leaching plant.

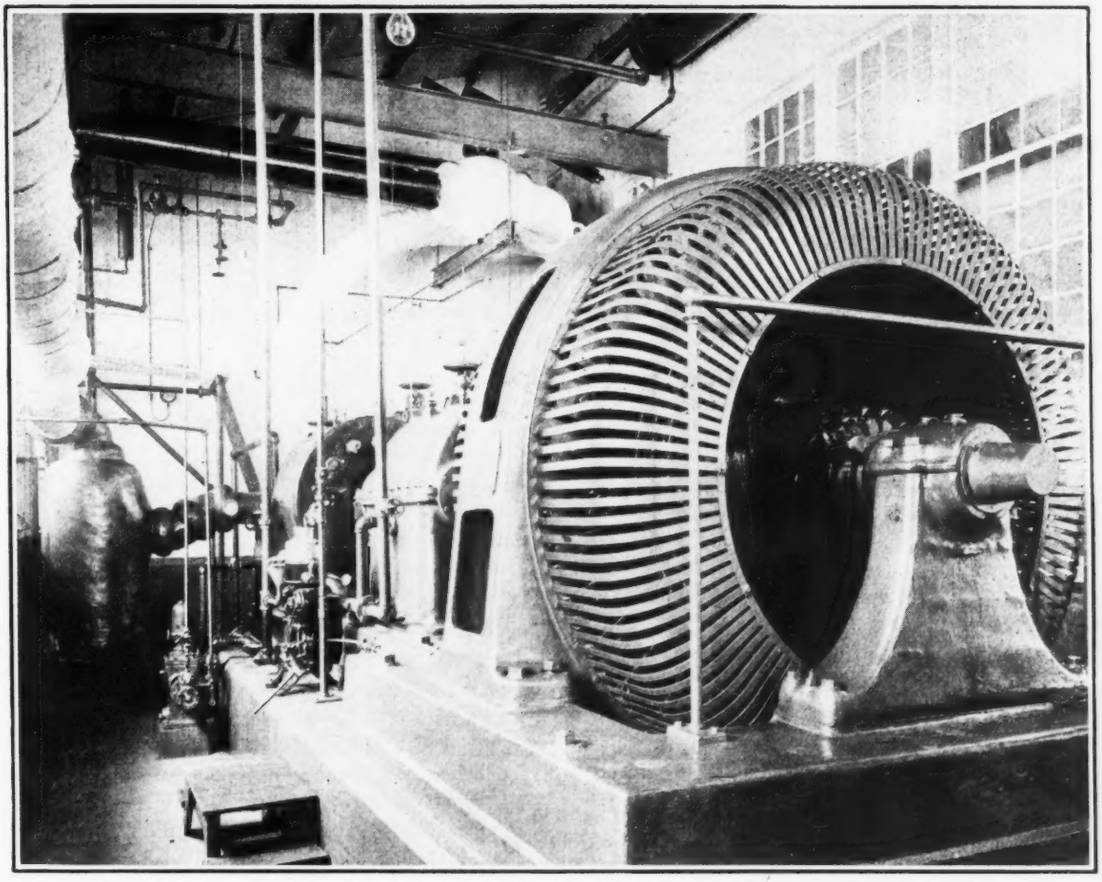


Fig. 6—This bleeder-type geared turbine, lately installed in the Lake Linden mill, exhausts 20-lb. steam used to operate the stills in the leaching process

Useful Operating Ideas

Rapid Drifting at Tintic Standard

By Gail Martin
Salt Lake City

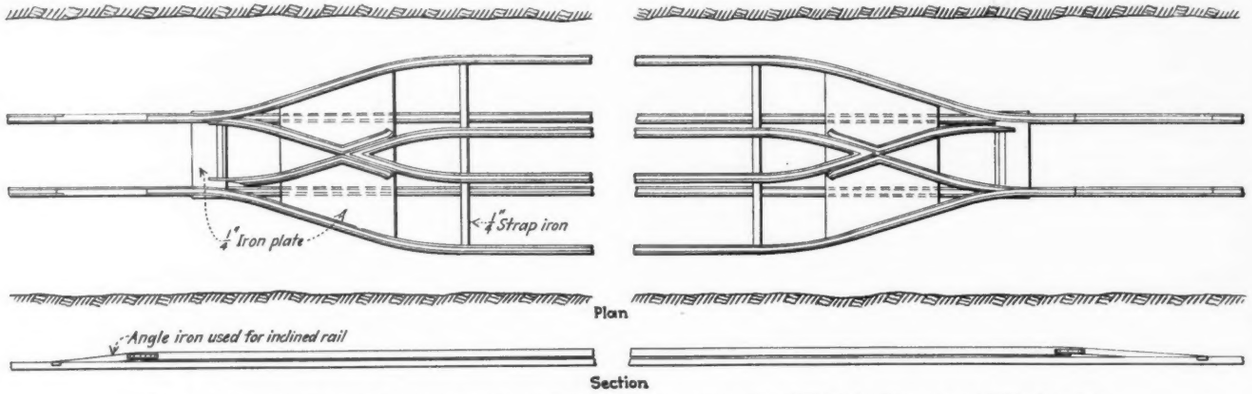
DEVELOPMENT in the East Tintic district, near Eureka, Utah, within the last four months has had two features that have centered wide attention on its activities—attainment of a drifting record by the Tintic Standard Mining Co., which sets a high mark for driving a single-face heading; and the making of a new mine, the North Lily, of the International Smelting Co. These achievements not only illustrate in a striking manner the superiority of modern mining methods over old, but demonstrate the practicability of the mechanical shovel. From Sept. 18, the date on which the Tintic Standard started to drift on a contract basis northwest from the 700 level of its No. 2 shaft into North Lily ground, until Jan. 4, when ore was exposed in the North Lily, a picked crew of fifteen men, using a compressed-air shovel, drove 2,400 ft. of drift, working three shifts a day.

During the month of maximum progress, 625 ft. of heading was made in twenty-six working days; during the week of maximum progress, 205 ft. in seven days. These are believed to be records that have never been equaled in the history of mining, although railroad tunnels have been advanced faster.

The speed attained by the Tintic Standard crew in driving the North Lily heading has proved that in the future much of the shoveling heretofore done by hand will be accomplished by mechanical loading devices. Those in charge of the work in the Tintic Standard are unanimous in the opinion that the phenomenal speed attained was possible mainly through the use of the air shovel. Ordinarily, keeping muck out of the way of the drilling crew is the chief problem of the operator, whereas with the mechanical shovel, the problem becomes one of keeping enough ground broken to keep the shovel busy. Whenever the footage dropped, it was not the fault of the shovel but inability of the drillers to make faster progress. With the air shovel in a 6.5x8-ft. drift, an average of twenty cars having a capacity of 18.5 cu.ft. each could be loaded in an hour. This is equivalent to twenty-three tons.

The modern shovel operates on compressed air and functions in many ways similar to the commonly known steam shovel. Operation of the shovel is so simple that it can be mastered without difficulty.

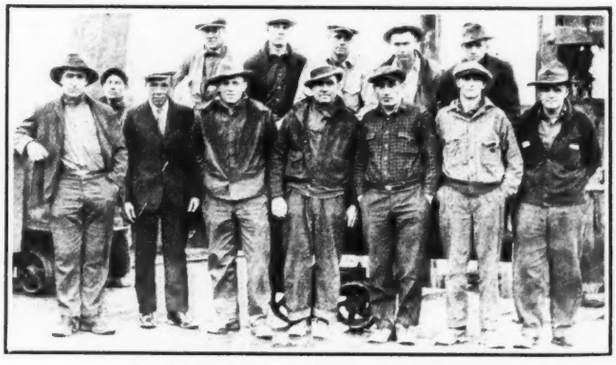
Fifteen men, consisting of three shovel operators, three trammers, five miners, and three mule skinners, with George Hezzlewood in charge, and the air shovel drove the 2,400 ft. of tunnel in less than four months. During this period there was only one minor hand accident. Labor turnover amounted to but seven men.



Plan of portable switch designed by George Hezzlewood, of Tintic Standard Mining Co.

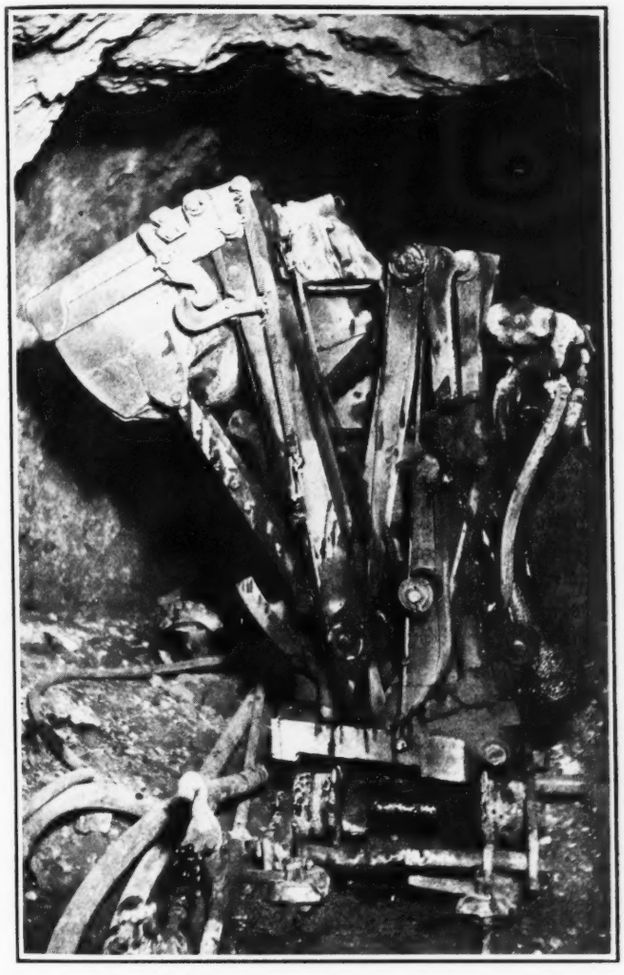
PORTABLE SWITCH

A portable switch, designed by Hezzlewood, and said to be one of the most useful innovations developed recently in Utah, contributed largely to the efficiency of operations. This switch gives ample facilities for the handling of cars without widening of the drift, tearing up of track, or setting of ties. The movable siding, which fits over the top of the permanent track, consists of a double track switch 40 ft. long, giving



Crew of Tintic Standard which drove North Lily drift in ground of the International Smelting Co.

Upper Row, Left to Right: N. H. Atkinson, M. O. Tatum, Melvin DeMill, John Davis, and James Berkley
Lower, Left to Right: Milo Burriston, mechanic; Ed Johnson, Guy Farley, Ed Riley, Ben Lippis, James Allen, and George Hezzlewood, shift boss and designer of the Hezzlewood portable switch



Compressed-air shovel in operation in North Lily drift

room for ten cars, with two equilateral turnouts at each end, shown in the diagram. Turnouts are spaced to give cars three inches of clearance. This device is kept about 150 ft. back of the face, so that ample cars may be available within short tramming distance. To move the switch it is only necessary to load it on trucks and haul it forward. To enable cars to overcome the difference in elevation between the permanent rails and the switch, amounting to two and a half inches, inclined rails are used. No clamps or spikes are required to fasten the switch to the track, as its weight is sufficient to hold it in place.

But Little Timbering Required

A greater part of the North Lily drift is untimbered, which augmented speed. Only 110 ft. is timbered. Timbering, when required, was done by the mining crew or a special timbering crew if possible. Three to four sets were placed per eight-hour shift. The number and type of drills, average length of round, and the number of holes drilled depended on the nature of the ground. In hard ground, two drifters mounted on a cross bar, a Sullivan DP641, and an Ingersoll Rand R72 were used.

Fourteen holes composed the average 6½-ft. round and consumed from two and one-half to three hours for drilling and setting up. In soft ground two Sullivan DR371 unmounted jackhammers were used to drill the average round of twelve holes, requiring from three-quarters of an hour to one and a half hours for drilling.

Ventilation was accomplished by the use of one No. 425 Coppus motor-driven fan, forcing fresh air through 4,000 ft. of 16-in. galvanized ventilating line. Two No. 300 Coppus pneumatic fans are connected in the line acting as booster fans. So efficient was ventilation that work could be resumed at the face thirty minutes after blasting.

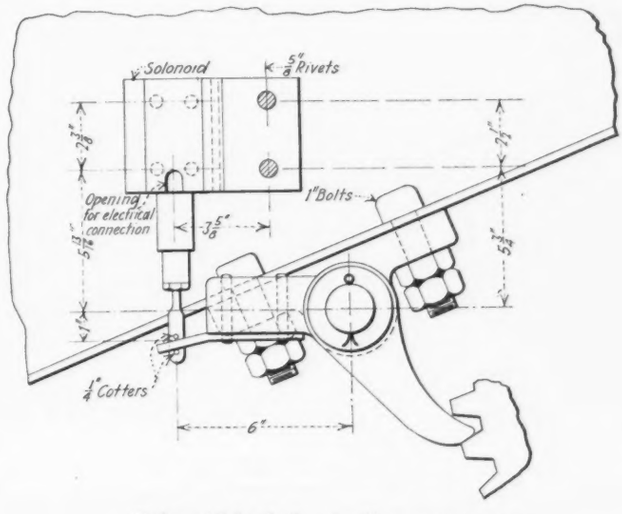
The shovel crew, consisting of two men, an operator and a trammer, operated the shovel, laid track and pipe, and trammed all cars to and from the shovel. A shift consisted of two miners, one shovel operator, one trammer, and one mule skinner. Members of the crew divided total footage receipts equally and co-operated in all ways to make ground, each doing any type of work that might be required in periods when routine operations were interrupted by dead work.

The average cycle of operations as outlined by L. R. Dobbs, superintendent, was as follows:

Time Required for Various Operations	Minute
Oiling shovel, barring down and preparing to drill	30-45
Drilling and mucking up to miners	90-120
Laying track, pipe, and ventilation line	60
Loading and blasting	30
Waiting for heading to clear	30
Average time, 285 minutes.	

Solenoid Lock for Incline Conveyors

Some kind of a locking device is necessary at the head of an incline conveyor belt run to prevent the loaded belt from reversing its direction of travel when it is stopped. At the Utah Copper Co.'s plants a conveyor lock operated by a solenoid was first used for this purpose on belt-driven inclined conveyor units. Subsequently when gear-driven units supplanted the belt drives a solenoid brake was applied to the motor shaft and is now standard. However, the first device is a satisfactory one for belt drives. It consists of a pawl which is pivoted upon a short shaft carried by a bracket at the conveyor head. The pawl engages in the driving gear. When the motor is stopped the solenoid automatically comes into action and throws the pawl into the main gear. When this stops the pawl locks into the gear, preventing any reversed motion. The solenoid coil is carried upon a bracket. Details of the arrangement are shown in the accompanying illustration.



Solenoid lock for incline conveyors

News of the Week

Summary

JOPLIN PRODUCTION declines while stocks increase—Old mills change hands—Tri-State zinc plans 350 ton mill—Vinegar Hill enlarges Wilson mill.

Lena Goldfields may go on Brussels Bourse—Panama Corporation issues progress report—Russo-Asiatic claims unsatisfied.

Shattuck-Denn and Calumet & Arizona start expansion program—Change proposed in "high-grading" law in California.

Gypsum mines at Caledonia, Ontario, produce 100,000 tons yearly—Canadian mint purchases $28,170,000 gold in 1926.

French's electrolytic zinc patents contested in Canadian courts—Many claims staked at Kamiskotia—Newbec takes over Rouyn properties.

Arkansas manganese mines produce 8,938 tons during 1926—Tonopah production increases in January.

Butte & Superior sinking to 3,600 level—U.V.X. orders equipment for Rouyn—Chief Consolidated curtails operations.

Lower power rates for northern Ontario—Development work progresses rapidly in many Ontario districts.

Germany buys lithium ores in Canada—Mayflower-Old Colony exploiting new lode in Michigan.

Mining vs. Agriculture in the Matter of Appropriations for Industrial Economics

By PAUL WOOTON
Special Washington Correspondent

THE printed record of the hearing on the Oddie bill proposing certain increases in the appropriations for the Bureau of Mines has become available. An extract from the comment of Senator Pittman on that occasion follows:

"Consider the first two items, namely, 'For mineral mining investigations, $25,000; for promoting mineral commerce, $40,000.' If such items related to agriculture instead of mining they would be included under the appropriation for the Bureau of Agricultural Economics.

"The third item, 'for operating mine rescue cars and stations, $55,500; and for investigating mine accidents, $35,000'; deals with the preservation of human life.

"The mining industry of the United States is the second largest industry, being only surpassed by the agricultural industry. The government has long ago recognized its duty toward a study of the economics of agriculture, for the purpose of proposing legislation that would stimulate, aid, and protect such industry. All of this work is done under the Bureau of Agricultural Economics. The bureau has proven of great value to the agricultural industry, and there can be no doubt that the establishment of a similar bureau in the Bureau of Mines would lend similar encouragement, aid, and protection to the mining industry.

"In the last Agricultural Department appropriation bill (H. R. 15008) the total sum of $4,981,251 is appropriated for the use of the Bureau of Agricultural Economics.

"The total amount appropriated in the Commerce Department appropriation bill for similar work and for the purposes named in S. 5329, above referred to, was less than $160,000. This clearly illustrates the disparity in the treatment by the government between the mining industry and the agricultural industry.

"I realize the difficulty in the situation, but I am unwilling to believe that the government is willing to abandon the mining industry without studying its problems and attempting to do something to encourage, aid, and protect such industry the same as it has other industries. There should be established in the Bureau of Mines a bureau of mineral economics, and this bureau should be as generously supported by the government as is the Bureau of Agricultural Economics.

"The fact that fatalities from mine accidents, measured by the number of men employed, are increasing, demands a serious and active endeavor of our government to ascertain the causes for such accidents and to provide remedies if possible. We can not measure the value of human life in money. No money is wasted that saves human life. No financial or economic policy should consider a saving which reduces the amount that is necessary to the proper preservation of human life."

Editor's Note — The record of the hearing on the bill proposing increased appropriations for the Bureau of Mines contains material of much interest to the mining industry. Copies will be furnished gratis on application to our correspondent, Paul Wooton, 604 Colorado Building, Washington, D. C.

South African Diamond Rush

Cable dispatches indicate that 20,000 runners took part on Friday, Feb. 25, in what probably was the greatest diamond rush in the history of South Africa. A special force of 200 police was mobilized at the Granfontein alluvial field near Lichtenburg, where thousands of persons are assembled from all parts of the Union.

All the prospectors started from a specified point at noon under government supervision. The distance to be covered by the runners, many of whom are professionals hired for the occasion, varied up to three miles.

Apart from the reputed richness of the newly discovered diamond field, this is the last rush before the enactment of new legislation prohibiting the present method of pegging claims.

Rice Injunction Made Permanent

George Graham Rice, and the Wall Street *Iconoclast*, published by him, were subjected to a double injunction obtained under the Martin Anti-Stock Fraud law by Attorney General Ottinger. The decision handed down by Supreme Court Justice Ellis J. Staley "makes" permanent a restraining order in the sale and promotion of stock of the Colombia Emerald Development Corporation. The new ruling requires Rice to make full disclosure of the financial affairs of the corporation to every prospective purchaser of the stock.

California Cement Companies Consolidate

The Pacific Portland Cement Co. and the Old Mission Portland Cement Co., both operating cement plants in California, have combined their resources. The Pacific operates two plants, one at

Cement, of 4,500-bbl. capacity, and a new plant at Redwood City, of 2,500-bbl. capacity. The Redwood City plant is to be enlarged by two additional rotary kilns, completion of which is planned for the early fall.

Limestone quarries are operated at Auburn, and the Redwood City plant receives its raw material from dredge operations in San Francisco Bay. Two plaster mills are operated also, one at Gerlach, Nev., of 500 tons' per day capacity, and the other at Plaster City, Imperial County, of 300 tons' daily capacity. Old Mission operates a cement plant and quarry at San Juan Bautista, the capacity being 2,000 bbl.

The new company is reported to have a capitalization of $30,000,000, consisting of 300,000 shares of $100 par value each. The new name is to be Pacific Portland Cement Co.

New California Mining Operations

The Kirby Development Corporation has been granted a permit to sell stock in California for exploring mining claims midway between Angels Camp and San Andreas, Calif. Likewise, the Virginia Lode Mines Co., which holds an option on the Old Virginia mine, south of Coulterville, was given a permit to sell stock for providing funds for exploration. The Virginia mine was worked for a number of years, reaching a depth of 1,000 ft. It was closed down some years ago.

The Mount Shasta Silica Co. was given a permit to sell additional shares for financing. This company has investigated a diatomite deposit in the Shasta region and plans to erect a plant for the preparation of finished products. The White Crystal Magnesia Co., controlling a magnesite deposit near Visalia, has been given permission to sell stock with the objective of providing funds for kiln equipment and accessories.

Champion Mine To Be Reopened

The Champion mine, of Mohave County, Ariz., has been taken over by P. M. Shelby, of San Francisco. Preparations are being made to unwater the shaft and to deepen it from its present depth of 300 ft. During operations of previous years an 18-ft. vein of complex ore was opened up on the 300 level and it is this vein which is the object of the new operations.

Champion was a good producer of lead in the early eighties. The ore was shipped to smelters at Benson and Pueblo. Later the United States Smelting, Refining & Mining Co. shipped a large tonnage to a mill at Needles. The concentrates from this mill were sent to the smelter at Midvale and to zinc plants in Oklahoma.

Oliver Adds Four Electric Shovels

Four new Model 120-B Bucyrus electric shovels equipped with four yard dippers have been purchased by the Oliver Iron Mining Co. for spring delivery. Two of these will be used in the Hibbing district and two in the Virginia district on the Mesabi range.

Utah Apex Reserves Increasing

R. F. Haffenreffer, Jr., president of the Utah Apex Mining Co., estimates that in the Bingham, Utah, property unmined reserves amount to 50,000 tons of lead-copper milling ore averaging 5 per cent lead and 3.16 per cent copper; 20,000 tons averaging 8 per cent lead and 5 per cent zinc; and 35,000 tons of copper shipping ore averaging 5 per cent copper; a total of 90,000 tons, compared with 63,000 tons for the year preceding.

Development work is now being done in lower levels from the 2,400-50 winze. Installation of a double-drum hoist and a large motor will be followed by sinking the shaft to the 2,600 level.

Standard Mill Destroyed by Fire

Fire of unknown origin destroyed the Standard mine mill, one mile west of Picher, Okla., on Feb. 9. The plant was of 250 tons' capacity and had been used in recent months as a tailing mill. It was operated by George Potter and associates, of Picher. The loss was partly covered by insurance. The mine was opened up some years ago by the American Metal Co. It is not likely it will be rebuilt, for the present at least.

Carbon-Black Plant Ready for Operation

Initial tests are now being made at the new carbon-black plant of the Crystal Carbon Co., Cisco, Colo., and it is expected that it will be placed in operation immediately. One large storehouse has been completed and another is to be built in the spring. The production of carbon black will be about two carloads each week.

Coronation Completes Mill

The Coronation mine, Field, B. C., on Cadwallader Creek, in the Lillooet mining division, is developing well, and recently a 40-ton Denver quartz mill has been erected. The mine adjoins the Pioneer mine, which was reopened in 1924, and which produced gold to the value of $61,000 in 1925. The production for last year has not yet been announced. During last year the shaft at the Coronation was sunk an additional 200 ft. and a drift was run for 800 ft. on a 3½-ft. vein which averages about $18 in gold per ton. The vein occurs in augite diorite and it carries its size and value to depths so far reached, namely 600 ft. in the Pioneer mine. Both mines are under the same management, and recently the syndicate that is developing them has acquired the adjoining Lorne mine.

Whitewater Mines Declare Dividend

Whitewater Mines has declared a dividend of 10 per cent on its preferred shares, which brings the total disbursement since April 20, 1926, when the first dividend was paid, up to $35,000. When $100,000, or 100 per cent, has been paid on the preferred shares they will automatically be converted into common shares. The deep development of the Whitewater mine, at Retallack, B. C., is being watched with much interest, as it is more than 500 ft. deeper than the deepest workings of any other mine in the Slocan district. A large body of milling ore recently has been opened between the 1,700 and the 1,850 levels, and the directors consider that enough ore now has been developed to justify the erection of a mill, the construction on the first 150-ton unit of which will be started in the spring. The present company reopened the mine in 1924, and during last year it shipped 9,595 tons of milling ore, 211 tons of clean galena, and 32 tons of clean blende to the Trail smelter. The milling ore assays about 6 oz. of silver per ton, 6 per cent of lead, and 15 per cent of zinc.

Tri-State Notes

The Tri-State Zinc Co. plans immediate construction of a 350-ton mill on the old Blue Mound lease, in the Joplin-Miami district, according to a statement by A. J. Klamt, district manager for the company. Drilling has developed untouched orebodies in the southwestern part of the lease.

The Vinegar Hill Zinc Co. is adding an annex to its Wilson mill in the Joplin-Miami district, to work over tailings according to a plan developed by C. O. Anderson, formerly with the U. S. Bureau of Mines, but now metallurgist for the Vinegar Hill company.

Mine "dirt" will be run over the mill as usual, but the slimes and fines will be mixed with the slimes and fines from the tailing mill. The tailings will be sized, after they are taken to the annex mill. The coarser tailings will be put over a four-cell rougher jig and the finer over a five-cell jig. A ball mill also will be installed in the annex mill to handle the chats.

Joplin Production Declines

Production of zinc ore in the Joplin-Miami district has been steadily reduced in recent weeks, on account of unattractive ore prices. For the week ended Feb. 5 the output was only 12,678 tons. This compares with an average output around 17,000 tons weekly during 1926.

Despite the reduced production, surplus ore stocks, both of sold and unsold ore, in the district are mounting. Total stocks amounted to 33,550 tons on Feb. 5, and the net unsold tonnage was 27,565. This alone is sufficient to prevent any material advance in price in the near future.

Carson Continues Patent Litigation

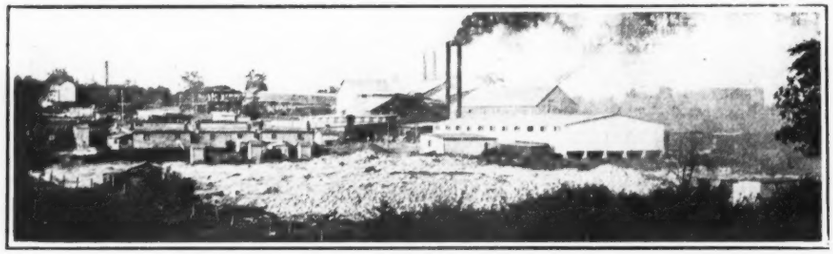
Patent - infringement proceedings brought by the Carson Investment companies against the United Verde Copper Co. and the United Verde Extension Co., both of Jerome, Ariz., will be opened in the federal court at Prescott, Ariz., on March 15, 1927. In the accounting between the Carson Investment Co. and the American Smelting & Refining Co., O. G. Ellis, special master in chancery, opened accounting proceedings on the 23d of the current month at Tacoma, Wash.

The Gypsum Industry at Caledonia, Ontario

Only Operating Company Mines About 100,000 Tons Yearly—Manufactures Wall Board, Building Blocks and Similar Materials

By W. A. Gordan
Port Dover, Ontario

THE plant of the Ontario Gypsum Co. is about one mile northeast of the village of Caledonia, on the highway to Hamilton, Ont. This plant was first started in 1905 by the Alabastine Co., of Paris, Ont., when the mine was first opened. Since then the plant has been enlarged, and in 1917 the Alabastine company and the Crown Gypsum Co. amalgamated to form the Ontario Gypsum Co., taking over mines and mills, the Alabastine company continuing at Paris to manufacture wall tints and similar products. In 1920 the Canada Plaster Board Co. and some years later the Ebsary Gypsum Co. were also bought out by the Ontario Gypsum Co., which is the only company mining, crushing, grinding, and calcining gypsum in Ontario. It also operates plaster mill and wallboard mill at Caledonia, and the gypsum mine and plaster mill at Lythmore.



Plant of the Ontario Gypsum Co., Caledonia, Ont.

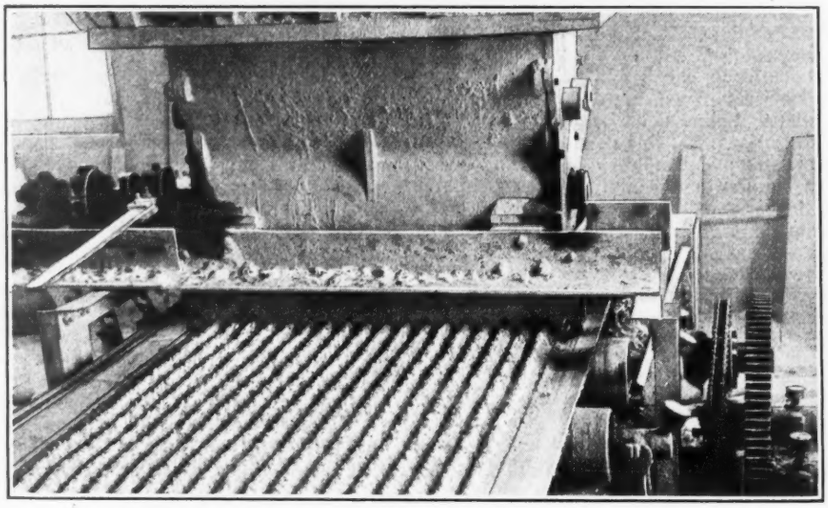
When the Caledonia mine was opened, in 1905, a slope was driven on a grade of one in ten in a westerly direction. The gypsum rock was hauled to the surface in one-ton cars and dumped into storage bins. Some was sold to cement manufacturers and the remainder was shipped to Paris, Ont., for calcining at the Alabastine plant.

Later on another slope was driven deeper, when a much better grade of gypsum was discovered. The room-and-pillar system used in coal mines was followed, the rooms being 20 ft. square and the pillars 12 ft. wide. In the process of mining, electric drills are used to bore holes in the rock, which are then shot with a charge of low-grade dynamite. At present the company has mined an area of more than 60 acres. The yield of gypsum to the acre is about 4,000 tons for each foot of thickness of the bed.

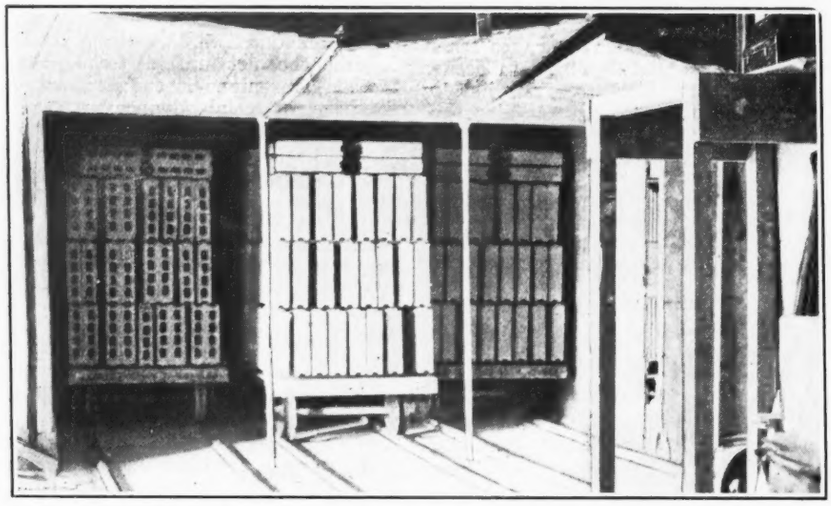
Production at this plant for 1924 was 98,324 tons mined. Shipments were 38,767 tons crushed, 306 tons fine-ground, 7,603 tons calcined, and 41,445 tons in manufactured products, of a value of $467,097. There were 156 employees, to whom was paid in wages $184,045.

One of the most interesting parts of the plant is that where building blocks are turned out mechanically at the rate of sixteen every minute. These are loaded on trucks and run into the drying kilns, of which there are three 110 ft. in length, with two tracks in each. The blocks are dried by heat from steam coils, the time being four days.

Gypsum board, as its name implies, is a board made of gypsum, mixed with wood fiber or sawdust, which will give toughness and lightness to the board. The powdered gypsum and the proper proportion of wood fiber are mixed in a hopper which spreads it on a conveyor belt and at the same time grooves it so that it will take up water readily. The mix then passes on the belt through a pan of water, where water is taken up by the material, later to form a solid mass. It travels along this belt and is fed onto a sheet of tough chipboard paper, on which it is spread out evenly by the machine. Another sheet of paper covers it and creases the paper along the edges, the board then traveling through a series of rollers which smooth it out. The board has a width of 32 in. and including paper is ⅜ in. thick, and can be turned out in lengths of from three to ten feet. Having reached the end of the belt, the pulp has set completely and the board is broken off in sections at the perforations made by the machine. It is then passed to the drying trucks, which hold thirty-two boards each, and these are then moved into the drying kilns, where they are dried by steam heat at a temperature of 200 deg. Each car of board remains eleven hours in the kilns.



Wall board plant showing "mix" passing to belt



Drying oven for building blocks, Ontario Gypsum Co.

This company now employs 260 men at the Caledonia plant, and has lately erected another large warehouse for wallboard. It also operates a plant at Lythmore which employs about forty men and it has a large plant at Paris, Ont., where the "Alabastine" wall tints are manufactured.

U.V.X. Orders Equipment for Rouyn

An electrically driven plant has been ordered by the United Verde Extension Mining Co. for the Murray property in the Rouyn area of Quebec, which U.V.X. optioned last fall. It is expected that the plant will be shipped at once, and when it is installed a shaft will be put down to the depth of 300 ft. Diamond-drill holes will be put down at intervals of 100 ft. during the work. Operations will be in charge of Alan Anderson, who was at the Millcrest, in Gowganda, last summer. E. B. Stevens is consulting engineer.

Montana Mining Notes

Trout Mining Co., formerly a subsidiary of the Manhattan Electrical Supply Co., has been doing a substantial amount of developing at its properties near Philipsburg, Mont. The company, which is one of the largest producers of battery manganese, has not been shipping any ores recently, but expects to start its magnetic separator within the next few weeks.

Moonlight Mining Co., Philipsburg, Mont., has started on a development program in its Huffman, Mullins, and Heinze manganese claims. The company owns a small magnetic mill. The Scratchawl property, formerly a producer of lead-zinc-silver ores, has been taken over by the Silver Prince Mining Co., of Philipsburg. A shaft is being raised to the surface from a tunnel on the 260 level, after which the shaft will be sunk to the 500 level.

According to advices received from Maxville, Mont., the Maxville Gold & Silver Mining & Development Co. has encountered high-grade silver-gold-lead-zinc ore near the main tunnel level.

The Madison Mining Co., Virginia City, Mont., is making plans to reconstruct its milling plant, recently destroyed by fire. The new plant will be located on the Winnetka mine, construction to be under the supervision of Charles A. Tout, of Butte.

Butte Superior Sinks to 3,600 Level

Butte & Superior Mining Co. is sinking one compartment and the ladderway of its main or No. 3 shaft from the 3,400 level to the 3,625 level. When that point is reached the shaft will be enlarged so as to make it standard three-compartment. Recently the company encountered the top of a commercial copper orebody on its 3,400 level at a point about 200 ft. south of the shaft. This is the first copper ore encountered on the Rainbow lode by this company. The Rainbow lode, which is 250 ft. wide, has been in the shaft since the 1,800 level. It is expected that copper ore will be encountered on the 3,600 level directly under the point where it was first encountered on the 3,400 level.

Royal Tiger Plans 2,500-Ton Mill

The Royal Tiger Mining Co., Breckenridge, Colo., recently announced, in a statement to stockholders, that it contemplated erecting a 2,500-ton mill for the treatment of the large tonnage of ore which is blocked out. During 1926 a great deal of development work took place. Two compressors and a four-drum electrically driven hoist have been installed in new buildings, which also include blacksmith and machine shop. A large saw mill is in operation at the property. New buildings have been erected to take care of the additional men employed.

Ophir District Active

Ophir mining district lying between Telluride and Rico, Colo., has been the scene of much renewed activity of late. This is due largely to the installation of the selective flotation process. San Bernardo's property, at Matterhorn, is on a good producing basis, the mill shipping about 25 cars of concentrates a month. The Carbonera property, which is on the divide northeast of the town of Ophir, is producing steadily and is shipping better than a car a day of lead-silver concentrates from its mill.

Southern Gypsum Sells Property

The manufacturing plant of the Southern Gypsum Co., North Holston, Va., has been sold to the Beaver Products Co. The purchasing corporation is said to be owned by Northern capital, and its officers indicate that large additional capital will be expended and that the plant will be increased.

Sumitomo Goshi-Kaisha Production

The Sumitomo Goshi-Kaisha copper company, Osaka, Japan, reports the December copper production as follows: Crude, 3,272.536 lb.; refined, 2,822.303 lb.

Old Mills Change Hands in Joplin-Miami Field

The Eagle-Picher Lead Co., Picher, Okla., has purchased the No. 2 mill and lease of the Dorothy Bill Mining Co., located near the Netta mine of the Eagle-Picher company, in the Joplin-Miami field. The mill will be torn down or moved to some other property, and the ore from the Dorothy Bill lease will be milled over the Netta concentrator.

The Cortez-King Brand Mines Corporation has purchased the Ellis mill of the Eagle-Picher Lead Co., at Crestline, Kan., and is moving it to the Sonny Boy lease, southwest of Baxter Springs. Two shafts have been completed into the ore at the Sonny Boy and considerable crosscutting completed.

United Mercury Developing Cinnabar Deposits

A recent report of the United Mercury Mines Co., Boise, Idaho, states that 10,441 ft. of development work has been done to date. In 1926 $417 worth of mercury was shipped from a small testing plant, and 87 tons of antimony ore from the antimony mine.

The company owns 1,500 acres of mineral land, which with development work has cost $564,480. The mercury ore is of low grade—5 lb. per ton. A larger tonnage is opened up and available for treatment.

Round Mountain Purchases Old Stamp Mill

The Round Mountain Mining Co., Round Mountain, Nev., has purchased the old stamp mill at the Liberty mine, 12 miles north from Tonopah, and has started to remove it to its Round Mountain property. It is believed that by increasing the capacity of the present milling plant at Round Mountain a profit can be made from the partly developed low-grade ore-body in the footwall of the Los Gazabos vein.

Mexican Quicksilver Mines Opened

An unusual amount of activity in the opening of cinnabar mines and construction of furnaces for the extraction of quicksilver is reported from various points in the states of Guerrero, Jalisco, and Chihuahua, Mexico. The high price of quicksilver has stimulated the mining of the lower grades of cinnabar ore. Several mines, situated in the districts of Chilpancingo, San Juan de Union, Huiztac, Naranjo, Taxco Viejo, and Huahuaxtla, have been reopened recently, old furnaces rehabilitated, and new furnaces constructed. In the State of Chihuahua immediately south of the cinnabar mines of Terlingua, Tex., several prospects are being developed.

Sheridan Copper Mine Reopened

Preparations are being made to resume the operation of the Sheridan copper mine, formerly operated by the Sheridan Mining Co., and situated 7 miles west of Burnet, Tex. The Burnet Copper Co. at Burnet, was recently incorporated to take over and operate the property. The company has a capital stock of $300,000, the principal stockholders being Dr. A. Howell and J. L. Williamson, of Burnet; Miss Mary Jones, of Brownwood, and Cyril D. Nelson, of Fort Worth. Prior to 1917 about $40,000 had been spent on development work.

Chief Consolidated Curtails Operations

Declining metal prices and the high costs of pumping have caused the Chief Consolidated Mining Co. to curtail operations at its No. 1 mine at Eureka, Utah. Operations in this part of the property will be confined chiefly to upper levels. Chief production of the company is coming from the Plutus mine.

During 1926 the company shipped 159,283 tons of ore, dry weight, yielding, after transportation, sampling, and all operating charges, $564,580, as compared with 161,781 dry tons, returning a net of $347,183.13, for 1925. The quarterly dividend for Feb. 1 was passed by the company because earnings were not deemed sufficient. Considerable faith is pinned upon the company's Eureka Lily mine, adjoining the Tintic Standard, where in crosscutting Eureka Lily ground to reach the North Lily mine of the International Smelting, 40 ft. of low-grade ore was opened up during December.

Manganese Operations in Arkansas Active

Shipments in 1926 Were 8,938 Tons; Two New Mills Built; Drying Method Saves One Dollar Per Ton

By Tom Shiras
Mountain Home, Ark.

PRODUCTION of manganese ore in the Batesville-Cushman (Arkansas) field in 1926 amounted in round figures to 8,938 tons. The principal producers were Walter H. Denison T. F. Shell, Shell & Beatty, Arkala Manganese Ore Co., and Miller & Rinehart. Of the total tonnage 1,830 tons was high-grade, averaging 51.20 per cent manganese, and the rest was low-grade ranging from 20 to 30 per cent manganese and about 15 per cent iron. Walter H. Denison maintained a local market for ore at Cushman, making during the year purchases from the smaller producers of high-grade ore.

On account of scarcity of labor, some difficulty was encountered late in the fall in filling high-grade ore contracts, but this condition was overcome when crops were gathered, which made farm labor available for mining.

No noteworthy new orebodies were discovered during the year, and production was slightly less than in recent former years. Demand for high-grade was strong, and the market for low-grade manganese was good.

Though the price has not been affected to an appreciable extent, the demand has been better and contracts have been more easy to obtain. This has been caused largely from the fact that manufacturers of cast iron are demanding a pig iron from the furnaces containing approximately one-half of 1 per cent manganese.

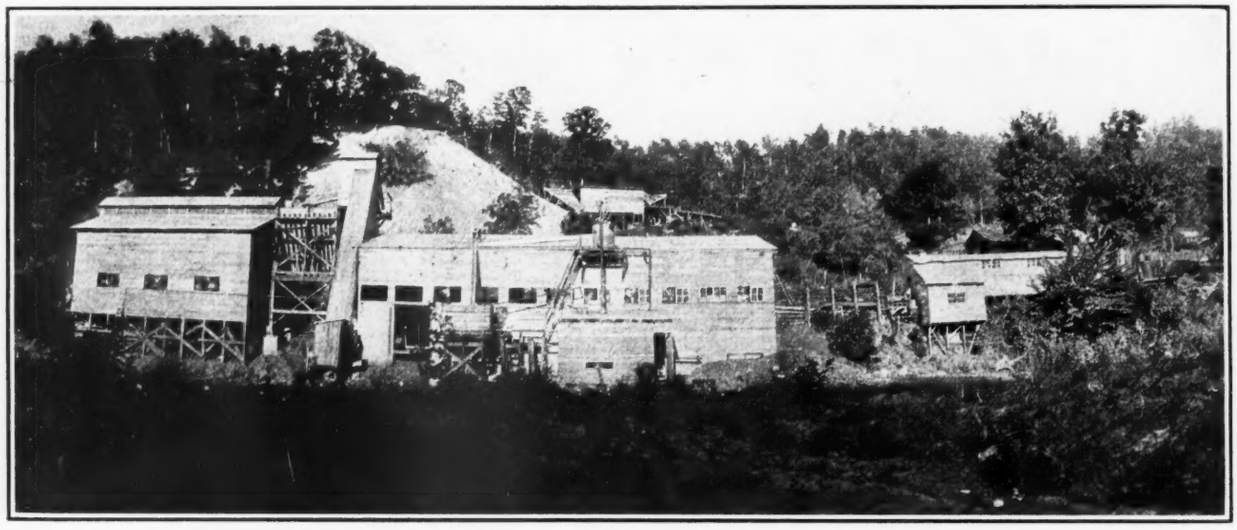
Two new washing plants were built during the last half of 1926. One by Miller & Rinehart, on their property three miles north of Batesville, and the other by the Arkala Manganese Ore Co., 7 miles from Cushman. The latter concern also constructed an industrial railroad 7 miles long from the property to Cushman, where it connects with the Missouri Pacific Railroad. The ore cars are moved over this track with a twelve-ton Vulcan gasoline locomotive.

The washing plant installed by the Arkala company will handle approximately three hundred yards of crude ore a day, and is built somewhat after the same design as the iron-ore washing plants in the Birmingham district. With this plant the company expects to produce from 30 to 40 tons of clean ore a day, all of low grade.

Miller & Rinehart are cleaning the fine ore on tables and drying it before shipping. During the last few months they have supplied the furnaces with ore of probably the lowest moisture content the smelters have ever purchased. The ore at this property is mined in large open pits several hundred feet above the mill in the valley, and is washed from the pits to the plant through a flume. The mine flume carrying the crude ore empties into two 30-ft. long washers, which do the preliminary cleaning. From the logs the solids pass through a ¼-in. revolving screen, the oversize being discharged onto a belt conveyor, where the ore is sorted by hand, the waste being thrown out. Everything from ¼-in. down passes to a ⅜-in. revolving screen. The oversize goes to a set of high-speed 30-in. rolls, and back to the ⅜-in. screen. Everything from this screen goes to two Wilfrey tables, where it receives the final cleaning. From the tables, the cleaned ore is elevated to a storage bin, where it is drained, then is passed through a 60-ft. Hardinge drier, which removes the moisture. It is then ready for shipment.

The tables and drier are the first equipment of their kind to be used in the field, and Mr. Rinehart, general manager, states that they show him a good saving. By better cleaning, the tables have raised the grade of his ore 5 points, and the drier has reduced the moisture content 28 per cent. The reduction of the moisture saves them approximately 75c. a ton in railroad freight, and 25c. a ton on hauling. The plant handles approximately 200 yd. of crude ore a day, from which they recover from twenty-five to thirty tons of finished ore.

The overburden at this property is from 1 ft. to 12 ft. thick, and stripping is carried on with a steam shovel. The ore is mined and moved by pick and shovel and wheelbarrow. Mr. Rinehart stated that as soon as sufficient stripping had been done he would probably use the steam shovel on the ore.



Miller & Rinehart concentrating plant, Batesville-Cushman district, Arkansas

January Production at Tonopah Increases

January bullion production by the mines of the Tonopah (Nevada) district showed a gain over that of previous months, with a gross value of $162,800. The increase was due partly to better grade of ore milled by the Tonopah Mining Co. and partly to improved quotations in the price of silver. The Tonopah Mining Co. shipped $102,000, which represents its own production and that of the Tonopah Belmont Development Co., as well as miscellaneous custom ore; West End, $33,400; and Tonopah Extension, $27,400.

Favorable reports emanate from the Tonopah Extension, and the new ore-shoot discovered on the 1,540 level, in the Merton vein, has been drifted on for over 100 ft. No immediate increase in tonnage is expected from this territory, as new track for motor haulage must be laid and the problem of ventilation be solved first.

Seneca Increasing Output

Seneca, in the Michigan copper district, has increased production, and three stamp heads in the mill now are being used instead of two. Average output is 1,500 tons daily, as compared with 1,300 in the last few months. In No. 1 shaft, drifting will be started soon on two new levels, the 8th and 9th. Timbering and rail construction in the shaft and crosscuts to the vein now are in the final stages. Openings throughout the mine are in good ground and drifts are being extended.

Shattuck-Denn and Calumet & Arizona Initiate Expansion Program

Extensive developments have been launched at the long-closed Cole shaft at the Calumet & Arizona Mining Co., which was one of the earliest and largest mineral producers in the Bisbee district. It is five years since work at this shaft was discontinued, and a considerable quantity of ore was extracted from that area during the period when work was in progress. The shaft was sunk to a depth of 1,500 ft., and active operations came to an end in 1921. A new Allis-Chalmers double-drum hoist will be installed at the Cole shaft in the near future and the shaft will be retimbered and other equipment installed.

Diamond-drilling operations will also start soon at the John Daisy claims, which are owned jointly by the Calumet & Arizona and the Shattuck-Denn mining companies. It is planned to explore this property entirely by the use of the diamond drill, and orebodies will be explored to a depth of 1,000 ft. by this method.

Validity of French's Patent Attacked

An action to invalidate a patent for the electrolytic process of zinc reduction, claimed to be the invention of Andrew Gordon French and now owned by French's Complex Ore Reduction Company of Canada, Ltd., has been launched in the Exchequer Court of Canada by the Electrolytic Zinc Process Co. against the French concern. The action was taken following a suit of the French company against the Electrolytic Zinc Process Co. for infringement of patent and for an accounting of profits of the last-named company in the manufacture of zinc by electrolysis since 1915.

Under the present action the validity of the patent for the process of ore reduction is attacked. The earlier action for infringement of patent is still pending in the courts. The Electrolytic Zinc Process Co. is controlled by the Consolidated Mining & Smelting Co. and the Anaconda Copper Mining Co.

Arcadian Consolidated Officers Are Optimistic

At the annual meeting of the Arcadian Consolidated Mining Co., held at Houghton, Mich., on Feb. 8, directors and officers were re-elected. Robert H. Shields, president, advises stockholders that, notwithstanding extra expense incident to the construction of the hoisting plant at the Baltic shaft, the company has no indebtedness, bonded or otherwise; has a substantial cash balance, and that there remains due from assessments, $45,961. The cash balance is $13,831. In addition, there are also in the treasury 42,700 shares of treasury stock, not including 13,000 shares of unissued stock. Receipts during the year were $82,670.35 and disbursements, $68,839.11.

The company is about to resume development work in the Baltic shaft, in which values are particularly promising. Openings will be extended south to connect with those from the Arcadian shaft. President Shields states that "with more extensive openings, and with a better price for copper, it may be conservatively stated Arcadian has better than an even chance of becoming a successful mining enterprice." A total of 967 ft. of drifting and crosscutting was done in the Arcadian shaft in 1926.

Canadian Mint Purchased $28,170,000 in Gold in 1926

A remarkable increase in the value of raw gold purchased by the Royal Mint of Canada in 1926 as compared with 1925 is a feature of the summary of Dominion Bureau of Statistics. In a paragraph explanatory of the serious decline in exports last year, as compared with the record for the previous year, occur the following words:

"The most notable decrease in Canadian exports occurred in the item "gold-bearing quartz and nuggets," which from 1925 to 1926 decreased from $31,433,000 to $7,340,000, or $24,093,000. The production in 1925 was valued at $35,880,000 and in 1926 at $35,749,000, and consequently the decrease in exports was not the result of a decrease in production.

"In 1925 the Royal Mint, however, only purchased Canadian raw gold of a value of about $2,500,000, whereas in 1926, it purchased Canadian raw gold of a value of about $28,170,000. In other words, the amount of Canadian raw gold purchased by the Royal Mint in 1925, plus the amount exported, practically equaled the production and in 1926 the amount purchased by the Royal Mint, plus the amount exported, again nearly equaled production."

Open-pit mine on Miller & Rinehart property described on opposite page

Proposed Changes in California's High-Grading Law

Modification of California's high-grading law which became effective July 24, 1925, is now being proposed in the present legislature. The law was sponsored by mine operators of California and was practically the only legislation in the nature of relief sought by the mining industry during the last ten years. It has successfully suppressed to a large extent ore amalgam and bullion stealing in California mines. Mining interests in Trinity County, though approving the purpose of the law, are now opposed to some of its provisions, especially the one relative to the buyer's license fee of $100, contending that it is an indirect tax on gold production. However, this provision is no different from that prevailing in ordinary departments of merchandising. The license provision does not apply to the prospector or other person marketing his own gold production, as such gold can be sent to the United States Mint or can be so sent in care of any storekeeper with whom he may be doing business. The law does not interfere with the prospector or honest storekeeper, but is intended to curb the practice of boarding-house keepers and some storekeepers in communities supported by important mining operations, from buying stolen ore from employees. Although from some angles there is no special objection to the reduction of license fee, most operators whose interests are vitally affected are disposed to insist that the law remain as it is, as it is the only available method of suppressing high grading. The search of employees has not been found practicable.

One operator of an important gold mine stated that the law afforded substantial relief to the gold-mining industry of California. Reports indicate that its operation has been followed by a material reduction in stealings.

Repeal of the present law would deprive the gold-mining industry of its fair measure of protection and would provoke the return of conditions which have been partly eradicated. The suggestion to reduce the bond requirement of $3,000 necessary for those dealing in bullion and ores is also opposed by the important producers.

Alaska Juneau in January

Alaska Juneau mined and trammed 380,130 tons to mill in January, 1926. Receipts totaled $241,000, or 63.4c. per ton. Expenditures totaled $195,000, or 51.35c. per ton. Operating profit was $45,800 or 12.05c. per ton. Other expenditures and accrued charges totaled $20,500 for the month, leaving a surplus of $25,300.

Many Claims Staked in Kamiskotia, Ontario

Upward of 50,000 acres have already been staked in the Kamiskotia Lake copper country, northwestern Ontario, since the rush started last November. Prospecting is still going on and to date 1,300 claims have been recorded at the South Porcupine recording office. Recently from twenty-five to fifty claims have been recorded daily. Ten townships have figured in the staking to date. Hollinger interests are reported to have acquired close to 100 claims, or about 4,000 acres, in the Kamiskotia area. In addition to the discovery claims which that company secured, it has optioned about seventy claims. A road has been completed to the property and diamond drilling started. The McIntyre, Dome, O'Brien and others of the established mines have had men in the Kamiskotia area, but to date the Hollinger mine is the only one to begin active work.

Gold Hill Operating New Electric Hoist

Gold Hill Mines, Ltd., Haileybury, Ontario, started its new electrically driven plant recently. The present plant has a much greater capacity than the old steam-driven one and is ample to develop the mine to a depth of 1,500 ft. A new headframe had to be built, and this is about 70 ft. high. It is constructed in such a way that direct connection can be made with the mill, which is to be built at once. The shaft is to be continued from the 800 level to the 1,500 level.

Premier-Paymaster Operating on Low-Grade Ore

Operations at the Premier-Paymaster mine, in the Porcupine area of Ontario, are being watched with much interest by mining men, owing to the low grade of ore that is being treated. Though general costs of the gold mines of northern Ontario run from $4 to $7 per ton, the attempt is being made to operate profitably where the gold content averages $3 per ton. The expectation of success is based on the great size of the deposit and the fact that the ore lends itself readily to concentration.

Germany Buys Lithium Ores from Canada

The first carload shipment of lithium ores, including spodumene and lepidolite, to leave Canada has been shipped from Lac du Bonnet, Manitoba, to Germany. This is a new development in connection with the exploitation of nonmetallic minerals in Canada, according to a recent announcement by H. B. Lumsden, of the development branch of the Canadian Pacific Railway, whose department has rendered assistance to the owners of the deposits producing these ores, which deposits are located on the Winnipeg River, not far from Pointe du Bois. The deposits are operated by the Silver Leaf Mining Syndicate, with headquarters at Bradford, England.

Sylvanite Mill Delayed

Another producer will be added to the Kirkland Lake ranks in less than three months. Expectations that the Sylvanite Gold Mines would have its new mill running before the end of February have been upset by delays in the delivery of the equipment. Slow deliveries have so delayed the installation of the machinery that it will likely be the latter part of April before the mill is operated. At any rate, officials of the company are confident that milling will have started by May 1. The mill is now in the final stages of construction. Kirkland Lake's newest mill will handle 200 tons of ore daily and its design and construction are of the most modern.

Newbec Mines, Ltd., Take Over Rouyn Properties

An important merger of several of the promising properties in the Rouyn area of Quebec has been effected. The Rouyn Gold Pan, Norbec Mines, and the Fred McLeod properties have been taken over by a new company. The Newbec Mines, Ltd., with a capital of $5,000,000, of which $2,500,000 has been placed in the treasury, has $50,000 in hand to finance exploration work. The properties are adjacent to the Waite-Montgomery on the east and southeast, and contain a deposit in which showings of chalcopyrite occur. Among those identified with the enterprice are James Y. Mudock, president of the Noranda; Bert Ray, of Toronto, and Peter Graham, of New Liskeard.

Canada Gypsum Expands

Important construction work is to be undertaken at Pinkney's Point, near Yarmouth, Nova Scotia, by the Canadian Gypsum Co., according to an announcement made by Otis Wack, president of the company. Wharves and storage bins will be constructed and large areas prepared for storage of products of the company's quarries near Windsor, N. S. The work will be started prior to April 1. The plans provide for an expenditure of $180,000.

Red Top Discovers Tungsten Ore

Tungsten ore has been discovered on the property of the Red Top Mining Co., in Stevens County, Wash. For a long time it was not recognized. J. Richard Brown, president and manager of the company, thought it was tungsten, but was repeatedly told that it was not. Finally he had it assayed and learned that it is scheelite. This is perhaps the only scheelite found in the State of Washington, although wolframite has been produced extensively from the Germania mine in the other corner of Stevens County.

Mr. Brown reports that the scheelite occurs as nodules in the lead-zinc ore and iron ore of the Red Top mine in at least three different places, and there is reason to expect it in other openings. It is in a contact vein of blue limestone and quartzite. Other properties in the district, including the Gladstone and Electric Point, are on the lookout for similar ore.

Nova Scotia May Cancel Lead-Mining Leases

At a recent sitting of the Nova Scotia Legislature a measure was introduced by the Hon. Gordon Harrington, Minister of Works and Mines, confirming the forfeiture of two lead-mining areas in Colchester County. Moving second reading of the bill, the minister explained that the two leases had been held thirty-five and thirty-six years, respectively, and in all that time the entire expense to the holders had been less than $5,000, no attempt having been made to work them.

The lease holders, not a trust company, had asked for $40,000 for the leases and refused an offer of $10,000. After a judicial hearing presided over by the minister, a report had gone to the Governor-in-Council recommending the forfeiture of the leases to applicants who undertook to work the areas and spend over $100,000 upon them. The recommendations had been approved and ordered carried out by the Governor-in-Council, and the present measure, the minister said, was to safeguard the new lessees.

Stadamac Purchases Ontabec No. 5

An important mining deal has been closed in Montreal whereby the Stadamac Mines, Ltd., of Montreal, purchased the Ontabec property No. 5, situated slightly northeast of Noranda, Quebec. This particular property has revealed attractive copper-gold showings. Assays from this group run up to 20 per cent copper. Work will be started immediately to explore the property. Ontabec, Ltd., will receive $50,000 cash and 250,000 shares of stock in the Stadamac company. This was not of the option variety, but an outright sale.

Mayflower-Old Colony Exploiting New Lode

At Mayflower-Old Colony, in the Michigan copper district, crosscutting will be stopped and drifting started on the strike of the copper-bearing lode recently encountered. The vein was cut at a depth of 1,700 ft., 2,700 ft. west of the shaft. The crosscut has been extended approximately 100 ft. beyond this point, without disclosing any new copper formation. Values in the vein now to be opened are encouraging where exposed in the crosscut. The width is five feet, which may widen as drifting proceeds. Even without widening, however, the lode would prove profitable with fairly consistent mineralization. The depth of 1,700 ft. and the fact that Mayflower has two miles on the strike of the vein are decidedly favorable factors.

Stowell Gold Acquires Rhodes Creek Mine

The Stowell Gold Mining Co., Spokane, Wash., has acquired the Rhodes Creek gold mine, three miles from the new railroad being built to Pierce City, Idaho. The Rhodes Creek was formerly known as the Bond & Crescent.

London Letter

By W. A. Doman
Special Correspondent

Lena Goldfields May Go on Brussels Bourse

Tetiuhe Corporation Improves Milling —Panama Issues Progress Report

London, Feb. 8—Leslie Urquhart's circular concerning the Russo-Asiatic Consolidated, in which he suggests that diplomatic negotiations should be broken off between Great Britain and the Soviet, has had a mixed reception. Some journals support him; but others —and perhaps these are the more sober ones—think that this extreme step would be unwise. The latter argue, in fact, that if such a step were taken not only the Soviet but people in this country would contend that the hand of the British Government had been forced by the capitalists—that is, by a few—and that the larger interests involved had been overlooked. Everyone sympathizes with Mr. Urquhart in his attitude and with his object, recognizing that the shareholders of his company have been badly treated. The difference of opinion is as to the remedy.

A report is current that an attempt is to be made to introduce Lena Goldfields shares to the Brussels Bourse. This does not meet with unusual approval in Brussels. The reason given is that as there are differences of opinion between the British and the Soviet regarding Russo-Asiatic, it would not do to allow the Soviet to think that it could by a roundabout way get something out of Belgium, and so show its independence of Great Britain. There is, however, another reason, and one that appeals to the Boursiers: that the Lena Goldfields is not paying dividends, and that though gross earnings are large, the net is not disclosed, and is probably swallowed up in charges. The prior securities, too, are at a heavy discount. Another point that is made in some of the English journals is that whereas the Soviet is on friendly terms with the Lena management, it is not amicably disposed toward the Russo-Asiatic, and the reason is asked. Is it because the directors of the two companies approach the Soviet in different ways?

The adjourned first annual general meeting of the shareholders of the Tetiuhe Mining Corporation was held last week, and A. Chester Beatty had quite a good story to tell of this Far-Eastern property. He, however, admitted—what I have pointed out more than once—that the low purchasing power of the chervonetz has increased the costs of working beyond what they were originally expected to be. Though the company is doing well, original hopes have not been entirely realized. An entirely new organization had to be built up in an isolated locality, and a new metallurgical process had to be decided upon. It has been proved that the extraction from mine ore will be considerably higher than that obtained from middlings or mill products, which had suffered through being stored for several years. In the future an extraction of 80 per cent of zinc in the form of 40 per cent to 45 per cent concentrates, and of 80 per cent of lead in the form of 70 per cent concentrates, can be expected. The ore reserves at Dec. 31 last were estimated at 840,000 long tons, averaging 8.2 oz. of silver, 10.8 per cent lead, and 13.2 per cent zinc. A second mill unit is to be erected, bringing the total capacity of the reduction works to 100,000 tons per annum.

The second progress report has been issued by the Panama Corporation, together with maps of the Veraguas and Darien concessions. In Hatillo district a tunnel has been driven 59 ft., and at 35 ft. a crosscut east and west disclosed a mineral formation over a total width of 24 ft. assaying 17 dwt. gold, 1½ oz. of silver, 12½ per cent lead, and 17½ per cent zinc. In the Remance mine, gold assays have a wide range.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Northern Ontario Offered Lower Power Rates

Mining Companies in Kirkland, Montbray and Rouyn Areas Continue Development with Good Results

With a view to settling the long-continued agitation against high power rates in the Kirkland district, the Northern Ontario Light & Power Co. has offered the operators there what is known as the "Hollinger contract." This contract calls for a price of $50 per horsepower for the first 5,000 hp., $30 per horsepower for the next 5,000 hp., $20 per horsepower for the next 5,000 hp. and $15 thereafter. Though this would result in a considerable reduction in the cost of power to the Kirkland operators, it is questionable whether they are as yet quite satisfied. One clause in the contract to which they take objection is the 85 per cent power factor. At present Kirkland operators pay a stand-by charge of $1 per month on the motor rating, with $2 per horsepower-month on the hoist motors, and pay for actual power consumed on a sliding scale, depending on the amount of horsepower used. However, there is no reduction beyond 500 horsepower, and as a consequence some of the companies in Kirkland claim that power costs them as much as $85 per horsepower-year.

No official announcement has been made, but it is understood that the Nipissing Mining Co. will bring in a mining plant to its properties in Montbray Township, Quebec. Recent diamond-drilling results have been extremely encouraging and have not only shown substantial values in copper, but also high values in gold. The officials express themselves as being pleased with the results, and there seems little question that the option will eventually be exercised. A winter road is being cut to the property to permit hauling in the plant and equipment.

It is stated that the electrical survey on the Laval-Quebec property has shown some interesting indications, which are to be diamond drilled. In the meantime, however, officials of the company are saying very little about it, in view of what transpired in connection with the electrical survey on the Area and Amulet properties.

On the Alderson-McKay property, in Rouyn, a dip-needle survey has indicated a new area of mineralization. The original discoveries on the Alderson-McKay were made as a result of a dip-needle survey, but the readings on the area recently indicated are stronger than on the old body. This shows a section 500 ft. long and of considerable width, and as the geology is considered favorable it is thought to have substantial possibilities. As soon as possible diamond drilling will be started in an effort to prove it up. On the original orebody drifting on the 175 level is confirming the results of the diamond drilling and the ore averages approximately $15 over widths up to 35 ft. A new plant is being installed, and sinking will then be continued to the 300 level.

During January the Dome Mines, of South Porcupine, milled 47,900 tons and recovered $327,850, an average of $6.85 a ton.

At the Ankerite mine, which is in the Dome section, improvements to the mill have brought the capacity up to 200 tons a day, and the grade is now about $7 a ton, which is also an increase. Better results are being obtained on the north vein, which is from 10 to 15 ft. wide, and this ore has been opened up only at one level.

Production of the Kirkland Lake Gold Mine in January was between $51,000 and $52,000, approximately the same as for December. The last four months' production was about $178,000, which should show quite a substantial margin of profit.

Officials of the Central Manitoba Mines, Ltd., are feeling pleased not only with mine development but also with their financing arrangements. The recent issue, which was put at $1 a share, has been heavily oversubscribed, and the company now has plenty of money to continue development and build a mill. On the 125 level the main oreshoot has been opened up for a length of a quarter of a mile, averaging $12 to $15 a ton over 5 ft. A 500-ft. length of ore has also been developed on the 375 level, and encouraging results are being encountered in the winze, which is now 100 ft. below the 375. Developments on the eastern section of the property are also promising, and substantial lengths of ore of higher grade and greater width are indicated.

The Eldorado Gold Mines is in the same district as the Central Manitoba, and it has a comparatively narrow vein traced over a long distance. Two small shafts have been put down 2,200 ft. apart. No. 1 has been sunk 55 ft. and gives average assays of $20 across 40 in. No. 2 has been sunk 42 ft. and gives an average of $16.80 across 40 in. Additional lengths have been opened up on the surface by trenching and blasting and a good deal of visible gold is shown.

Societies, Addresses, and Reports

The Mineral and Potential Water-Power Resources of the Gold Coast, Africa*

By A. E. Kitson
Director of the Gold Coast Geological Survey

THE GOLD COAST comprises three separate divisions, the Gold Coast Colony, Ashanti, and the Northern Territories, and with the Mandated Territory of Togoland has an area of 91,690 square miles, this being a little larger than Great Britain. It fronts the Gulf of Guinea, and is bounded on the west by the French Ivory Coast, on the north by French Upper Senegal and Niger, and on the east by Togoland under French mandate. More than half of its area is occupied by mineral-bearing rocks. A large portion of the remainder is covered with sandstones and sandy shales, and the sands derived therefrom. These rocks store large quantities of rain water, which issues as springs and soaks. There are besides in this area many occurrences of limestone of good quality.

The rocks are of sedimentary and igneous kinds, with metamorphosed representatives of both, and it is in these altered rocks mainly that the minerals of economic importance occur. Probably the oldest are folded sedimentary and volcanic rocks intruded by those of plutonic origin, mainly granites, porphyries, diorites, and amphibolites of different ages. At many places they are completely changed to gneisses of various kinds. Their general strike is N.E.-S.W.

The country has been subjected to an intense amount of erosion, as is evidenced by the absence of any definite representatives of rocks of the early Palaeozoic periods. Fossiliferous rocks are rare and comprise remnants of those of the Devonian, Carboniferous, and Jurassic or Cretaceous periods.

The minerals that occur in commercial quantities are gold, bauxite, diamonds, barite, and ores of manganese and tin. There are besides beautiful building and ornamental stones, marbles and limestones, brick, pottery and tile clays and shales, highly siliceous rocks, some oil shale, of poor quality, oil, bitumen, and saline springs.

Lode Gold Deposits

The banket reefs were originally beds of pebbles, grits, and pebbly and gritty sandstones which were once more or less flat bedded and have since been folded, crushed, and otherwise altered. In some parts their matrices are highly siliceous; in others mainly sericitic or chloritic. Gold occurs as free gold in very small particles in the matrix, but not in the pebbles. The rocks have a strong general resemblance to the banket of the Witwatersrand, but contain very little pyrite, thus differing from those of the Rand.

The Tarkwa-Abosso gold field is of the banket type. The reefs vary in width from 1 to 24 ft., but the average width extracted is about 4 ft. Ore yielding from 8 to upward of 12 dwt. of gold per ton is treated in the mills, the poorer banket being unprofitable under present conditions.

The quartz reefs have been formed by the deposition of quartz, gold, and sulphides, mainly of iron (pyrite) from hot solutions ascending along lines of fracture from deep-seated sources. They vary in width from less than an inch to upward of 20 ft., and have gold values of upward of 2 oz. per ton of ore. The Obuasi gold field (Ashanti Goldfields Mines) is an example of this type. Others are Prestea, Broomassie, and Akoko.

Dikes of acidic rocks and associated veins and masses are very common in the region adjacent to intrusions of granitic masses, and though by their denudation they have furnished a large amount of gold, in the aggregate they are not usually of importance for profitable working, owing to their lack of continuity as narrow, rich veins.

Placer Deposits

Alluvial gold is found mainly in the gravel and sand of streams, both those of their older terraces and those of the flats and in their beds. Many rivers, such as the Birrim, Pra, Ofin, and Ankobra, are richly auriferous along portions of their courses. They have been dredged, though with but moderate success, owing to various causes. Thousands of flats along small streams in many parts of the colony and Ashanti have been thickly dotted with the small, round vertical pits, from less than 5 ft. to upward of 20 ft. in depth, made by Africans of former days to get the metal to which the colony owes its name.

Production of gold before records were kept must have been very great. From 1903 to March 31, 1925, the total recorded quantity of gold from banket, quartz reefs, and alluvial sources is as follows:

	Ounces	Value
Banket	2,173,675	£9,233,729
Quartz reefs	3,118,203	13,246,126
Alluvial and small lode mines	441,241	1,874,391
Totals	5,733,119	£24,354,246

Manganese Deposits

There are three types of manganese deposits, which may be grouped as follows:

A. Manganese-bearing argillaceous phyllites and fine mica-schists.

B. Spessartite (manganese garnet) quartz rock, with or without rhodonite (manganese silicate), associated with biotite-paragneiss, biotite-schist, amphibolite, and other rocks. These are highly altered forms of Group A.

C. Segregation deposits formed by surface concentration of manganese oxide during weathering of rocks of A and B types.

These deposits occur in numerous districts in the colony, Ashanti, and the Northern Territories, on the strikes, mainly N.E.-S.W., of certain beds in the Birrim series, which is probably Pre-Cambrian. Owing to folding of the sediments they are visible at many places from the Birrim River near Dixcove on the coast to the northwest corner of the Northern Territories, a distance of 440 miles. The largest deposit occurs at Insuta-Dagwin, where it forms the major portion of a high ridge, extending for about 2 miles by the side of the Sekondi-Kumasi railway at 36 to 38 miles from the port of Sekondi. This huge deposit consists of massive ore and of "detrital" ore, the latter composed of manganese oxide in grains and small to large nodules in a red clayey soil. The ore is of high grade, and specially suitable for the manufacture of ferromanganese. The deposits were discovered by the Geological Survey in 1914, but were not developed till 1916. To March 31, 1925, 660,000 tons of manganese ore has been exported.

Bauxite Deposits

There are very large deposits of bauxite in the colony and Ashanti. In general they form caps on high hills and are mere remnants of former widespread deposits. Much the greater portion is of bauxite of good to very good quality. The principal deposits are those of Mount Ejuanema, Kwahu, which have been carefully tested by 130 pits and shafts, and proved to have an average thickness of about 20 ft., with a total quantity of four million tons, representing upward of 600,000 tons of the metal aluminium. The Ejuanema deposit is 1¼ miles in a direct line northeast from Nkawkaw railway station, which is 111 miles from the port of Accra, or 249 miles from the port of Sekondi, via Kumasi. It lies about 1,700 ft. above the railway, with practicable transport routes of 4¾ miles and 2½ miles in length from the deposit to Nkawkaw.

Bauxite Awaits Development

At Sefwi Bekwai a group of six hills shows caps of bauxite upward of 40 ft. in thickness. The cliffs on some of these hills vary from 30 to 90 ft. in height, but very little work of testing the deposits by the Geological Survey has been possible. Unbottomed shafts sunk on one of the hills show the deposit to be fully 48 ft. thick, but taking an average thickness of only 20 ft. the quantity of bauxite on this group of hills is 33.3 million tons, containing approximately six million tons of aluminium. The Sefwi Bekwai deposits are about 55 miles to northwest of Dunkwa, a station on the Sekondi-Kumasi railway, 100 miles from Sekondi. A motor road passes within 6 miles of Mount Supirri. These deposits still await development, for the cost of transport of the raw bauxite to the

*"Manganese Ore Deposits of the Gold Coast," by A. E. Kitson, was the subject of a paper read at the February (1927) meeting of the A.I.M.E.

coast is too great for profitable utilization at present.

Diamonds have a wide distribution in the Gold Coast, where they occur in the gravels of streams and old marine deposits over an area of some 20,000 square miles. Only in the Birrim River basin (over 1,200 square miles of it) have they, however, been found in payable quantities at several places.

The stones are of very good quality, but small when compared with those from most other diamond fields. The total recorded production to April, 1926, is 280,808 carats, valued at £330,900. The total quantity of gravel treated is not known definitely, but is supposed to be about 300,000 cu.yd.

Stream tin has been found in the concentrates of streams and in dikes of pegmatite and the débris therefrom at various places in the country, but alone at Mamkwadi, west of Winneba, is it known to occur in even fair quantities.

In the marine gravels around the shores of Mankofa Lagoon and in the small streams flowing into the lagoon there is a good deal of stream tin, with associated gold derived from the degradation of dikes of stanniferous pegmatite and aplite, while brown cassiterite also occurs in dikes of aplite that intrude hornblende- and actinolite-schists, on the marine platform between Mamkwadi and Apam.

Platinum has at last been discovered in the Gold Coast, where its presence had been suspected by me for years past. Near Mamkwadi I found a large dike of mineralized hornblendic rock bearing an appreciable proportion of yellow and grayish sulphides. Eight assays of this rock have been made. Though these results show the rock to be not commercially valuable they indicate the possibility of richer material being found in this or other localities, for there are great numbers of untested dikes of similar and allied basic and ultrabasic rocks in the country.

In the Gold Coast there are numerous rivers which by damming to conserve water during the wet season can be utilized to supply a large amount of hydro-electric power. Two, the Volta and the Black Volta, may be specially mentioned, for besides being large rivers, conveying immense quanties of water to the ocean during the wet season, they flow through narrow gorges where comparatively short dams can be built to impound huge volumes of water and furnish a valuable amount of hydro-electric power.

Steinmesch Talks to Missouri Students

J. H. Steinmesch, superintendent of the Desloge Consolidated Lead Co., at Desloge, Mo., on Jan. 14, addressed the Mining and Metallurgical Society of the Missouri School of Mines. Mr. Steinmesch, aided by lantern slides, discussed the varied practical problems which he has met and solved in his work since his graduation from the Missouri School of Mines and Metallurgy in 1906. Among the problems covered were those relating to the purchase and maintenance of equipment, underground development work, and experimentation on concentration and flotation with some hints on safety work in and around mines.

Fewer Accidents in Joplin District

The safety department of the Tri-State Zinc and Lead Ore Producers' Association reports that there were fewer accidents in the Joplin-Miami district during 1926 than in 1925, despite increased activity among the mines. A total of 4,590 accidents were reported in 1926, as against 4,663 in 1925. Of these accidents, 3,764 occurred in the mines, 427 in the mills, and 399 were experienced by surface employees. Almost 50 per cent of the mine accidents occurred in handling ore. There were 810 accidents in connection with loading cans (ore buckets) underground.

Eye injuries totaled 922, and 785 finger injuries are recorded.

Montana Section A.I.M.E. Elects Officers

The annual meeting of the Montana Section of the American Institute of Mining and Metallurgical Engineers was held at the Silver Bow Club, Butte, Mont., Feb. 8. Members, wives, and guests enjoyed a dinner-dance. The social session was subject to an intermission for the annual election of officers. Alexander Leggat, a Butte mining engineer, was elected chairman; Arthur E. Adami, of the Montana State School of Mines, was elected vice-chairman; E. M. Norris, group superintendent of the Anaconda Copper Mining Co., and Everett H. Parker, of the Elm Orlu Mining Co., were elected executive committeemen, and Alex M. McDonald, of the rock-drill department of the Anaconda Copper Mining Co., was re-elected secretary-treasurer.

Industrial Development Congress at Birmingham

The Southern Division of the American Mining Congress will hold its second annual Industrial Development Conference at Birmingham, Ala., on March 21 and 22. A large attendance of bankers, transportation heads, Chamber of Commerce executives, raw-material producers of all kinds, state geologists, representatives of Southern universities and technical schools, and large consumers (particularly of non-metallics) from the North and East is expected.

Moffat Tunnel Holes Through

President Coolidge set off the blast which broke down the last barrier between the two bores of the preliminary work of the Moffat Tunnel, in Colorado, on Friday night, Feb. 18, at 8:10 o'clock mountain standard time. Elaborate ceremonies in honor of the event were staged in Denver, conducted by Governor Adams of Colorado, and broadcast from radio station KOA of the General Electric Company in that city.

The preliminary tunnel completed by this blast is eight feet in diameter and has served as an exploration tube and, later, will be used as an aqueduct to carry water from the high western plateau into Denver. Following closely is the construction work on the main tunnel, 24 ft. by 16 ft. The Moffat Tunnel will be 6.04 miles long. Its eastern portal is 9,198 ft. above sea level, and the western portal 9,085 ft. The center of the tunnel is 4,160 ft. below the top of James Peak. Eastern grade is 0.3 per cent and western, 0.9 per cent. The tunnel passes directly under Crater Lake, and reduces the distance from Glenwood Springs, Colo., to Denver, from 343 miles to 173 miles. Electric locomotives will handle all traffic, and automobiles will be transported on flat cars.

San Francisco Section Banquets

The San Francisco section of the A.I.M.E. held its annual banquet on the evening of Feb. 16, 1927, at the Fairmont Hotel. Members of the Institute and the Women's Auxiliary were in attendance. Dean Probert, chairman of the section, presided. Charles W. Merrill, a director of the Institute, made a plea for increased attention to the undeveloped mineral resources of California. Prof. Andrew C. Lawson, in response to Mr. Merrill, pointed out the primary need for geological investigation of mineral deposits as a necessary preliminary to commercial development. Commenting upon his recent trip to Europe and Africa, he stated that other nations were especially keen in investigating mineral possibilities of new lands and were making active preparations to exploit such deposits as have been found promising. He stated that a small sum only would be necessary to carry on the work of geological investigation in California and advocated this policy strongly. Mrs. O. C. Ralston made a short address on behalf of the retiring officers of the Woman's Auxiliary and Mrs. W. H. Blackburn, the new president, was introduced. The new chairman of the section, William H. Grant, was represented by the vice-chairman of the San Francisco Section, J. E. Mitchell-Roberts. Mr. Grant was delegate to the annual meeting and was absent.

Reduction in Mine Accidents in Phelps Dodge Corporation

Statistics recently released by the Copper Queen labor department indicate a marked decrease in accidents at the various branches of the Phelps Dodge Corporation during the last three years. The report shows that the number of fatal accidents among employees of the four branches has been reduced from 20 in 1924 to 7 during the last year. In compiling the statistics, the following companies were included: Copper Queen, Bisbee and Douglas; Moctezuma Copper Co., Nacozari, Mexico; Morenci, at Morenci, Ariz., and Old Dominion Co. at Globe.

The report further revealed that the number of serious accidents was reduced from 597 in 1924 to 188 for the year 1926; and that the number of slight accidents was reduced from 1,769 in 1924 to 304 for the past year. Twelve foremen and shift foremen of the Copper Queen branch established an unusual record in 1926, when employees under their supervision worked the entire year without a time-lost accident.

People You Should Know About

Allen H. Rogers is in Chile.

F. D. Pagliuchi sailed from New York for Venezuela on Feb. 24.

Miller D. Hay has assumed the duties of Chief Mine Inspector of Oklahoma.

R. S. Neuberger, of the American Metal Co., arrived in New York from Chile on Feb. 15.

R. B. Lamb, mining engineer, formerly of New York, has established headquarters in Toronto.

Edwin C. Jordan has been appointed chief metallurgist of the new Double "EE" Research Laboratories, in Fullerton, Calif.

Walter Fitch, Sr., president of the Chief Consolidated Mining Co., is spending a few weeks at Coronado Beach, Calif.

W. A. Cole, general manager of the E. J. Longyear Co., with headquarters in Duluth, Minn., is visiting the mining camps in Arizona.

Howard D. Smith, of the Consolidated Copper Mines Corporation, of Kimberly, Nev., was recently in San Francisco on a business trip.

Messrs. Alderson and **McKay,** of Montreal, have been appointed the managers of the Ribago property, in the Rouyn district of Quebec.

L. D. Knight, manager of the Ingersoll-Rand company, is at the Salt Lake City office of the company after a business trip through the Northwest.

Matthew Van Siclen, engineer in charge of mining research, U. S. Bureau of Mines, Washington, D. C., has resigned to go into private practice.

M. C. Godbe, president and manager of the Nevada Half Moon Mining Co., is in Pioche, Nev., to start sinking operations in the Half Moon group.

R. O. Hocking of Hibbing, Minn., has been appointed general superintendent of mining operations of Butler Brothers with headquarters at Nashwauk, Minn.

Dr. W. N. Davis, professor emeritus of geology and a noted physiographer, will become a member of the staff of the college of mines at the University of Arizona.

Thomas Lyon, geologist for the International Smelting Co., returned to Salt Lake City recently from the Nort Lily mine, in the East Tintic district near Eureka.

George Oldright, metallurgist for the U. S. Bureau of Mines, is at the Rolla, Mo., station conducting an investigation into refractories used in lead and copper smelting.

Gerald FitzGerald, of the U. S. Geological Survey, left Washington, D. C., on Feb. 15 to make topographic surveys of the Chandalar-Sheenjek region of northern Alaska.

James O. Greenan, superintendent for the Consolidated Cortez Silver Mines Co. at Cortez, near Beowawe, Nev., has returned to the mine from a visit in Los Angeles.

George A. Kervin, general manager for the Mason Valley Mines Co., at Mason and Wabuska, Nev., has returned to the mine from a business trip to Salt Lake City.

Albert Ernest Kitson, Director of the Gold Coast Geological Survey, was knighted in the British New Year's Honors List. Sir Albert has had a wide and varied experience in his profession since graduating with honors at the Melbourne School of Mines and Melbourne University. From 1893 to 1906 he made surveys and examinations in all the Australian states, in Tasmania, in Victoria, and New South Wales. In

A. E. Kitson

1899 he was appointed to the Geological Survey of Victoria, Australia, and in 1905 Senior Field Geologist and Assistant Director. In 1907 he was made Principal of Mineral Survey, Southern Nigeria, British West Africa, by appointment of the Colonial Office. From 1907 to 1909 Sir Albert conducted geological explorations and mining operations in Southern Nigeria and Dahomey, making a special examination and report on the Gold Coast Colony. Later he conducted research and made examinations in the British Isles, Germany, Austria and Italy. He is the author of numerous reports and papers published by various departments and societies, official and other. In 1925 he compiled for the Governor of the Gold Coast, Bulletin No. 1 of the Gold Coast Geological Survey, outlining the mineral and waterpower resources of the colony, and containing also "Hints on Prospecting." On Sept. 22, 1926, the results of this later work were outlined in an address on "The Mineral and Potential Water-Power Resources of the Gold Coast, With Remarks on Prospecting Methods," a digest of which appears on page 380 of this issue.

William Sloan, Minister of Mines for British Columbia, has returned to Victoria from Honolulu, where he spent six weeks recuperating his health.

T. A. Rickard has been elected president of the English Speaking Union in California. This is a position which he occupied two years ago in the absence of **Charles M. Gayley,** whom he now succeeds.

Dr. W. O. Hotchkiss, president of the Michigan College of Mines, at Houghton, and **Professors Schubert, Seeber, Sperr,** and **Manderfield** attended the annual meeting of the American Institute of Mining and Metallurgical Engineers in New York City.

Dr. C. K. Leith, of the University of Wisconsin, lectured in February at the Army War College, in Washington, and at the Naval War College, at Newport, R. I., on "Some Consequences of the Concentration of Mineral Reserves About the North Atlantic."

Rush T. Sill, and **D. C. Peacock,** engineers of mines, of Los Angeles, Calif., recently made an examination of the "79" mine, at Winkelman, Ariz. Mr. Sill has also made an examination of the properties of the Morrison Development Co., at Patagonia, in the same state.

Guy C. Riddell and Mrs. Riddell were passengers on the S.S. "Finland," bound for Panama, when the driving shaft broke and made it necessary for the vessel to return to New York, for repairs. Mr. and Mrs. Riddell resumed their trip to Panama on Feb. 20.

Horace G. Young, formerly manager of the Castle Trethewey, of Gowganda, has been appointed manager of the Howey Gold Mines, operating in the Red Lake district of northern Ontario. **Douglas G. H. Wright,** for several years chief geologist of the Dome Mines, has been appointed chief geologist of the Howey.

Walter Emons and **Russell Cryderman,** well known in Manitoba mining circles in connection with their work on the Cryderman property, have been engaged by the Mining Corporation of Canada to make a geological survey of its properties in Montbray Township, in the Rouyn area of Quebec, in preparation for an electrical survey.

Dr. J. A. Bancroft, professor of the Dawson chair of geology at McGill University, has been granted a two years' leave of absence. He is sailing for Rhodesia and will join the staff of the Anglo American Corporation of South Africa. During his absence the duties of the department of minerology and geology will be assumed by **Prof. D. P. Graham,** associate professor of the chair.

Obituary

Patrick Yorke, an inventor of oil and gas drilling apparatus, died in Washington, Pa., on Feb. 13. He was seventy-four years old.

George D. B. Turner, mining engineer, formerly a well-known Montana operator, died at Oakland, Calif., on Jan. 27, aged fifty-seven.

John Mack, a pioneer mine operator in British Columbia and subsequently in the states of Washington and Idaho and the provinces of Ontario and Quebec, died recently at his home in Victoria, B. C. Mr. Mack was sixty-eight years old. He operated the Winnipeg mine, the first successful mine in the Boundary district of British Columbia, in the early 90's. He returned to Victoria from properties that he owns in Quebec only a few weeks ago.

Recent Technical Publications

Reviews, Abstracts, and References

Canadian Talc

Talc Deposits of Canada. By M. E. Wilson. Geological Survey, Canadian Department of Mines, Ottawa, Ont. Economic Geology, Series No. 2, 1926, Price 25c.

This report of 149 pages is geologic in character, dealing with the distribution, origin, general relationships, as well as commercial possibilities of talc and soapstone deposits in Canada. It is therefore a companion bulletin to "Talc and Soapstone in Canada," by H. S. Spence, published in 1922, the latter being chiefly technologic. The uses of talc are discussed briefly and tabulated. An admirable feature of the chapter dealing with the talc-bearing geological provinces is a brief summary at the end of each section. Technical literature of today is so abundant and the time for reading is so brief, that summaries by authors are becoming increasingly welcome. In the 16-page discussion of the origin of talc the districts studied in greatest detail by the author are cited, and many references to the literature are given. The major part of the report deals with descriptions of the deposits occurring in various parts of Canada. The most important commercial deposits of white high-grade talcs occur at Madoc, in Hastings County, Ontario. They are similar to the white talcs of northern Italy, southern France, and California. Foreign deposits are discussed briefly. Canadian production was about 10,000 tons in 1924.

OLIVER BOWLES.

Sedimentary Petrography

Supplement to an Introduction to Sedimentary Petrography. By Henry B. Milner. Thomas Murby & Co., 1, Fleet Lane, E.C. 4, London. D. Van Nostrand Co., New York.

Correlation by petrographic methods is made possible by noting (1) the frequency of occurrence of individual species, (2) the persistence of each species, or (3) by observing the constancy (or inconstancy) of certain mineralogical features. Comparison of grain size of the same species and the percentage of heavy residue are additional factors of considerable importance.

The original text on sedimentary petrography, published in 1922, contained descriptions of the physical and optical properties of 55 detrital minerals. Since then a considerable amount of new material has been collected which is now made available through the present supplement of 156 pages. Further instructions are given in the methods of treatment and analysis of sediments. The properties of 20 additional minerals are recorded, and 28 species are figured, making a total of over 50 detrital minerals illustrated in the text and supplement, while 74 species are described.

To explain the technique involved, 12 examples are given of correlation and differentiation by petrographic methods. The materials selected included sands from California, Texas, Oklahoma, Rumania and Galicia, as well as Cretaceous and Tertiary rocks of England. The concluding pages are devoted to nine detrital mineral determination tables and a bibliography of over one hundred entries.

The descriptions, as in the earlier text, are brief, while the illustrations are of unusual merit. The supplement no doubt will be favorably received by all petrographers and students of stratigraphy. It is to be hoped, however, that in the near future the combined subject matter of both text and supplement, properly co-ordinated, will be published in a single work of reference.

W. F. HUNT.

Mechanical and Electrical Year Books—Emmott & Co., 65 King St., Manchester, England, have recently issued two pocket year books for 1927, the "Mechanical World Year Book" and the "Mechanical World Electrical Pocket Book." Both contain a large amount of information, similar to that in the more expensive and complete American handbooks, written, of course, in the light of British practice. The price of each book is 1s. 6d.

Canadian Mining Reports—The following government mining reports have been issued recently, obtainable on request unless a price is given:

Ontario Department of Mines, Toronto, Thirty-fifth annual report, Part 3, containing the following papers: "Gowganda Silver Area (Fourth report, revised)," by A. G. Burrows, pp. 61; "Gowganda Vein Minerals," by E. W. Todd, pp. 15; and the "Anima-Nipissing Lake Area," by E. W. Todd, pp. 25.

Manufactures of the Non-Metallic Minerals in Canada, 1924, pp. 107, giving statistics and names and addresses of producers. Price 25c. from the Dominion Bureau of Statistics, Ottawa, Ont.

Ontario Department of Mines, Toronto, Thirty-fourth annual report, Part 1, 1925, containing the following sections: "Statistical Review, 1924," by W. R. Rogers and A. C. Young, pp. 60; "Mining Accidents in 1924" and "Mines of Ontario in 1924," by T. F. Sutherland, pp. 109; "Classes for Prospectors," by W. L. Goodwin, pp. 4; and "Power and Transportation," by A. A. Cole, pp. 7.

Ontario Department of Mines, Toronto, Thirty-fifth Annual Report, Part 4, "Reconnaissance from Red Lake to Favourable Lake, District of Patricia," by G. Vibert Douglas, pp. 28, with colored geological map of the Red Lake gold area.

Ontario Department of Mines, Toronto, Bulletin No. 58, "Metal Production of Ontario" for the first nine months of 1926, and the total mineral output for 1925 (revised), pp. 7.

Canadian Department of Mines, Mines Branch, Ottawa. "Investigations in Ore Dressing and Metallurgy, 1925," (Bulletin 670) containing the following papers: "General Review of Investigations," by W. B. Timm, pp. 11; "Ore Dressing and Metallurgical Laboratory," by C. S. Parsons, R. K. Carnochan, and J. S. Godard, pp. 64; "Electro-chemical and Hydrometallurgical Laboratory," by R. J. Traill and W. R. McClelland, pp. 18; "Pyrometallurgical Laboratory," by H. C. Mabee and A. E. Smaill, pp. 7; "Chemical Laboratory," by H. C. Mabee, pp. 2; "The Concentration of Canadian Molybdenite Ores," by W. B. Timm and C. S. Parsons, pp. 14; "The Concentration of Canadian Flake Graphite Ores," by C. S. Parsons, pp. 11; "The Ores of Western Quebec—Their Character and Metallurgical Treatment," by W. B. Timm, pp. 5.

Geological Survey, Canadian Department of Mines, Ottawa. Memoir 150, pp. 63. "Whitehorse District, Yukon," by W. E. Cockfield and A. H. Bell, with colored geological map. Price 20c.

Geological Survey, Ottawa. Memoir 149: "Placer and Vein Gold Deposits of Barkerville, Cariboo District, British Columbia," by W. A. Johnston and W. L. Uglow, pp. 246, with maps. Price 40c.

Report of the Department of Mines, Ottawa, for the year ending March 31, 1926. Pp. 77; price 20c.

Australian Mining and Metallurgy—No. 60 of the *Proceedings* of the Australasian Institute of Mining and Metallurgy, Melbourne, contains the following articles: "Investigations on Fume Losses at the Sulphide Corporation's Works at Cockle Creek, N. S. W." pp. 12, by G. Lindesay Clark; "Broken Hill Ore Chute Design," pp. 27, by J. W. Salter; and "Notes on a Railway Tunnel Carried on Timber," pp. 4, by Gerald W. Young. Bulletin No. 61 contains a list of members.

Mine Pumping and Hauling—In *The Mining Congress Journal* for November (Washington, D. C.; price 30c.) appeared two short articles of a practical nature, "Deep Mine Pumping at Calumet & Arizona," by E. F. Irving, in which the new equipment consists of horizontal, duplex, four-plunger, outside center-packed pumps; and "Handy Hoisting and Hauling for Mines," describing the use of the small single-drum hoist for various purposes.

Alabama Iron Ores—Technical Paper 377 of the U. S. Bureau of Mines, pp. 41, obtainable from the Superintendent of Documents, Washington, D. C., for 10c., is entitled "Red Iron Ores and Ferruginous Sandstones of the Clinton Formation in the Birmingham District, Alabama." The author is W. R. Crane. This is a report of a systematic study with respect to variations of composition along the strike and down the dip, and affords much information regarding supplies of raw material should a suitable means of beneficiation be devised.

Asbestos—The Mineral Section, Bureau of Foreign and Domestic Commerce, Washington, D. C., has recently issued Trade Information Bulletin No. 442 entitled "Asbestos Sources and Trade."

Potash Industry—"L'Industrie Mondiale de la Potasse" is discussed by J.-A. Douffiagues and Rene Gadonneix in Vol. 10, No. 9, of Annales des Mines (Dunod, 92, Rue Bonaparte (VI), Paris, France; price 37c., or 7fr. 50). Both the technical and economic phases of the world potash industry are covered in this 48-page article.

West Virginia Geology—The West Virginia Geological Survey, Morgantown, W. Va., has recently issued a volume on the detailed county survey of Mercer, Eastern Summers, and Monroe counties, together with accompanying maps, embracing about 1,000 pages. Copies are obtainable for $3.50; and the maps are also sold separately.

Labor Turnover—The Policyholders' Service Bureau of the Metropolitan Life Insurance Co., New York City, is issuing for free distribution a series of booklets on labor turnover problems, giving much helpful information and advice to employers of labor.

South African Mining—The annual reports of the Secretary for Mines and Industries and of the Government Mining Engineer for the calendar year 1925 is now available for 10s. 6d. from the Government Printing and Stationery Office, Pretoria.

Illinois Petroleum—Press Bulletin, Series No. 6 has recently been issued by the State Geological Survey, Urbana, Ill., from whom it may be obtained for 25c. The Sorento dome area in parts of Madison, Montgomery, and Bond counties is described.

Rock Drill Dust—The Safety in Mines Research Board has published Paper No. 23, "A Method of Trapping the Dust Produced by Pneumatic Rock Drills," a short abstract of which appears in *Engineering* of Dec. 31. The bulletin may be obtained for 6d., from H. M. Stationery Office, Adastral House, Kingsway, W. C. 2, England.

Mineral Resources—Recently issued separates of "Mineral Resources of the United States, 1925," and the prices for which they may be obtained from the Superintendent of Documents, Washington, D. C., follow: "Platinum and Allied Metals," pp. 11, by James M. Hill, 5c.; "Iron Ore, Pig Iron, and Steel," pp. 38, by Hubert W. Davis, 10c.; "Chromite," pp. 21, by J. W. Furness, 5c.; "Mercury," pp. 17, by J. W. Furness, 5c.; "Asphalt and Related Bitumens," pp. 9, by G. R. Hopkins and A. B. Coons, 5c.; "Feldspar," pp. 8, by Jefferson Middleton, 5c.; "Graphite," pp. 6, by Jefferson Middleton, 5c.; "Asbestos," pp. 8, by Blanche H. Stoddard, 5c.; "Slate," pp. 12, by A. T. Coons, 5c.; "Magnesium and Its Compounds," pp. 15, by J. M. Hill, 5c.; "Salt, Bromine, and Calcium Chloride," pp. 15, by A. T. Coons, 5c.; "Barite and Barium Products," pp. 8, by A. Stoll and R. M. Santmyers, 5c.; "Clay," pp. 9, by Jefferson Middleton, 5c.; "Natural Gas." pp. 8, by G. R. Hopkins, 5c.; "Phosphate Rock," pp. 18, by W. M. Weigel and B. H. Stoddard, 5c.; "Abrasive Materials," pp. 9, by Frank J. Katz, 5c.; and "Natural-Gas Gasoline," pp. 6, by G. R. Hopkins, 5c. In the report for 1924, the following chapter was also recently issued: "Gold, Silver, and Copper in South Dakota and Wyoming," pp. 5, by C. W. Henderson, 5c.

Metallurgical Plant Design—In the December issue of *Mining and Metallurgy* (New York City; price 50c.) is an 8-page article by M. R. Hull entitled "Metallurgical Plant Design and Construction," which was read before the Montana section of the A.I.M.E. last September. Among the factors discussed are the selection of a site, water supply, power requirements, general plant layout, factors affecting design, and kind of equipment to use. Detailed data are included.

Coley Zinc Process—A brief description of the new Coley process of zinc distillation, as developed in England, illustrated with photographs of the equipment used, appeared in *The Industrial Chemist* of November, 1926. (33 Tothill St., Westminster, London, S. W. 1; price 1 shilling.)

Santa Catalina Tramways — In the magazine mentioned in the preceding paragraph is also a short description of the aërial tramway at Santa Catalina Island, California. This tramway is of the detachable bucket type, 9,900 ft. long by 10-ft. gage. The greatest span is 1,800 ft.

Flotation Process—Two valuable bulletins of interest to all flotation operators have been issued recently. Of first importance is one entitled "The Trend of Flotation," by Arthur J. Weinig and Irving A. Palmer, published by the Colorado School of Mines, Golden, Colo. Among the subjects treated in this 62-page booklet are: types of ore adapted to flotation, kinds of flotation, theory of the process, description of reagents, consumption of reagents (from Varley's report), general equipment, testing, data on flotation practice at various mills, with costs; royalties and patents, marketing of flotation concentrates, manufacturers of flotation machines; and, from the *E. & M. J.*, tables of freight rates, and a bibliography. A good index should be mentioned also. The authors have done an exceedingly creditable job, and the bulletin will no doubt be in wide request, as such information has been difficult to get in such handy form.

The other booklet referred to in the paragraph above is published by a manufacturer of flotation equipment, the Southwestern Engineering Corporation, Los Angeles, but is none the less valuable on that account. It is a reprint of a series of articles by Robert Lord and B. M. Snyder, that have been published from time to time in *The Southwestern Bulletin.* These articles include data on the treatment of various individual minerals of gold, silver, copper, mercury, lead, zinc, iron, manganese, calcium, barium, carbon, molybdenum, bismuth, tungsten, and vanadium; brief descriptions of the reagents and oils commonly used; a chapter on gangue interference; one on the influence of soluble salts; one on the flotation of oxidized ores; and data on characteristic results that can be secured with certain typical ores. This 30-page bulletin will be furnished cheerfully on request to the publishers.

Patents

Rock Drilling Equipment

No. 1,616,470. Feb. 8, 1927. W. A. Smith, Athens, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design for a rock drill.

Nos. 1,616,486-87-88-89-90. Feb. 8, 1927. G. H. Gilman, Belmont, Mass. Designs for drilling machines.

No. 1,617,025. Feb. 8, 1927. Takasuke Nakayama, Osaka, Japan, assignor to Seimei Hara and Goshikaisha Nakayama Kogyo-Sho, Osaka, Japan. A rock drill, driven by an electric motor.

No. 1,617,225. Feb. 8, 1927. A. H. Skaer and O. E. Clark, Denver, assignors to the Denver Rock Drill Manufacturing Co., Denver. A drill-sharpening apparatus.

No. 1,617,518. Feb. 15, 1927. C. C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J. Design of the valve chest for a rock drill.

Nos. 1,617,914-5. Feb. 15, 1827. A. H. Katterjohn, Denver, assignor to the Denver Rock Drill Manufacturing Co., Denver. Design of rock drill parts.

Screen—No. 1,616,472. Feb. 8, 1927. A. H. Stebbins, Los Angeles. Designs for a ribbed screen.

Amalgamator—No. 1,616,784. Feb. 8, 1927. H. A. Crosby, Stettler, Alberta, Canada. A centrifugal amalgamating device for saving gold.

Concentrator—No. 1,616,791. Feb. 8, 1927. Antoine France, Liége, Belgium. A device for controlling the discharge from a specific-gravity separator.

Gyratory Crusher — No. 1,616,844. Feb. 8, 1927. J. G. Burke, Allentown, Pa., assignor to Bradley Pulverizer Co., Allentown, Pa. Supporting and driving construction for gyratory grinding mills.

Torsion Balance—No. 1,617,823. Feb. 15, 1927. Stephen Rybar, Budapest, Hungary. A modification of the Eötvös torsion balance.

Ore Sintering—No. 1,618,116. Feb. 15, 1927. H. G. Torulf, Stockholm, Sweden. A sintering system comprising independent portable sintering vessels and exhausting apparatus, and a railway for transporting the vessels of sintered material.

Mine Car Equipment

No. 1,616,564. Feb. 8, 1927. Leopold Almquist, New York, and Victor Willoughby, Ridgewood, N. J., assignors to American Car & Foundry Co., New York. Design of mine car doors.

No. 1,616,573. Feb. 8, 1927. H. P. Field, Berwick, Pa., assignor to American Car & Foundry Co., New York City. Drop-door apparatus for mine cars.

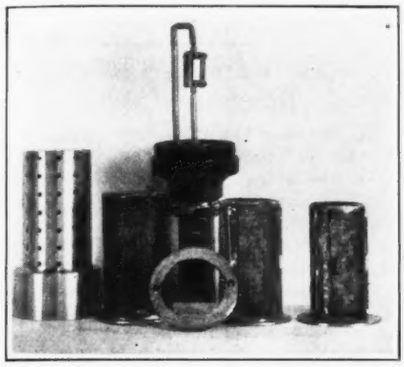
No. 1,616,578. Feb. 8, 1927. W. V. Johnson, Bloomsburg, Pa., assignor to American Car & Foundry Co., New York City. A journal bearing for mine cars.

No. 1,617,628. Feb. 15, 1927. C. H. Gage, Washington, D. C., assignor to L. W. Searles, Chevy Chase, Md.; W. A. Faison, Chester, Pa.; and W. D. Riter, Washington, D. C., trustees. A draw bar and coupler for mine cars.

New Machinery and Inventions

New Device Detects Methane Electrically

This Gas, So Common in Coal Mines, Also Occurs in Workings Where Other Minerals Are Being Taken Out, Though Cases Are Rare



Methane detector (left) and its parts

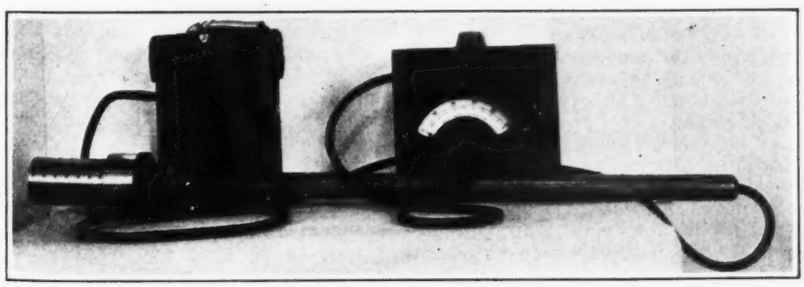
AT THE recent meeting in New York of the American Institute of Mining and Metallurgical Engineers, D. Harrington, of the U. S. Bureau of Mines, in presenting the report of the committee on metal-mine ventilation, said that methane (or fire damp) had been encountered in several "non-coal" mines and that one of them now used a safety lamp in certain parts of the property. Although such occurrences are probably rare, nevertheless the circumstance indicates that the coal miner is not the only person who must give attention to the possibilities of danger from methane.

In this connection it is interesting to note that an electrical device for detecting methane has recently been invented. It has been developed through co-operative research work instigated by coal mine operators and state legislators of Utah. Among the organizations which offered their services for this endeavor was the Union Carbide & Carbon Corporation. At its Long Island City laboratories a group of men, led by E. K. Judd, has been working for two years on the idea that since combustible gas is the cause of the explosions, an automatic, accurate, and rugged detector of combustible gas would be the best possible means with which to avoid them.

The basis of the device is a platinum coil, about 1 in. long and .005 in. in diameter. When such a filament is heated to a constant temperature, it becomes slightly hotter in the presence of methane or other hydrocarbon gas. The more methane, the hotter the platinum coil gets. It is secured at the end of a stick and connected with a portable storage battery, which heats it. The current from the battery is maintained constant by a simple automatic control, so any variation in the temperature of the coil is caused by the combustion of methane at the surface of the wire. The temperature of the coil is then shown on a dial indicator, which is so calibrated as to register the amount of methane in the atmosphere around the coil. To prevent an explosion, the coil is protected by the same gauze bonnets developed for a safety lamp a century ago by Sir Humphry Davy.

As it can be attached to a telescopic stick of any length, this sensitive instrument can be poked into the highest crevice on a mine level. The wires connecting it to the battery and indicator, of course, can be of any desired length. Battery and indicator are carried on the fire boss's belt. Indicators permanently placed in the entries would be wired to a recording device in the mine office, and could be made to ring warning signals when the gas content rises above a point that is considered safe.

Though the indicator registers immediately the presence of an increasing amount of methane in a steady action of the needle, if there is 5 per cent methane in the air (the danger point), the needle will swing back and forth rapidly. The detector, it is claimed, has met with unvarying success in both laboratory and field tests.



Methane detector, battery case, and dial indicator ready for use

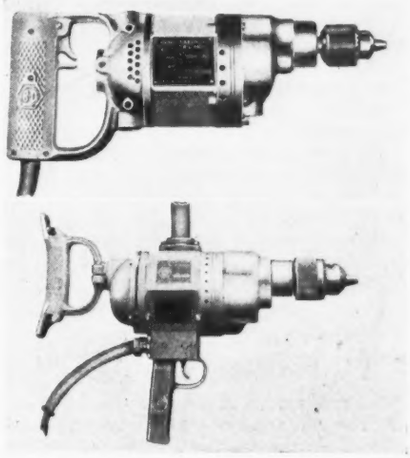
Test New Type Pulverizers

New types of coal pulverizers are being tested by the fuel conservation committee of the U. S. Fleet Corporation at the League Island Navy Yard, Philadelphia, in conjunction with the tests now being made of pulverized coal for raising steam in Scotch marine boilers. One type of pulverizer has been discovered which powders the coal so fine that it may be passed through a 300-mesh screen.

Two New Electric Drills

Improvements on the ¼-in. standard ball bearing electric drill have been announced by the Black & Decker Mfg. Co., Towson, Md. This drill, shown at the top in the accompanying illustration, is intended to replace the light ¼-in. drill made by this company. The new machine is provided with an improved universal motor that drives the chuck through a double reduction gear unit at a no-load speed of 2,000 r.p.m. All rotating shafts are mounted upon ball bearings. The tool is capable of drilling holes up to ¼ in. in diameter in steel, it is said, and weighs 6 lb.

The other drill shown is portable and designed to drill holes up to ⅝ in. in steel or up to 2 in. in wood. A universal motor, designed for this type of service, is used. Normal open-type ball bearings are used on the armature shaft.



These drills will use either a.c. or d.c. current

Ash from Powdered-Fuel Plants Precipitated Electrically

The first and only large installation of equipment for the electric precipitation of ash in a powdered-fuel boiler plant is being installed at the Trenton Channel power plant of the Detroit Edison Co. The installation, having what will probably be a higher power rating than any other single electric precipitation plant ever built, is being made under the supervision of the Research Corporation of New York City, and involves the use of the Cottrell process.

The smoke given off from this boiler plant carries with it a large amount of fine ash, which, if it were not removed in some way, would result in the distribution from the stacks of many tons of ash over the surrounding countryside. By means of the new precipitator this will be practically eliminated.

Nine precipitator units will comprise the final installation, each being served by two 25-kva. electrical sets. Two precipitator units are already in use, and the remainder will be installed early this year.

The high voltage power will be supplied from eighteen specially designed 25-kva. transformers, of which fourteen units are now under construction at

the Pittsfield plant of the General Electric Co. These units will step up the 220-volt, single-phase, 60-cycle power supply to 75,000 volts. The high voltage will then be passed through mechanical rectifiers built by the Research Corporation and each driven by a single-horsepower, ball-bearing, synchronous motor of special G.E. design. High-voltage direct current from the rectifier will be applied directly to the treaters.

The precipitators are of the graded-resistance type, consisting of parallel grounded concrete plates, between which will be suspended anodes connected to the negative side of the direct-current circuit. The positive side of the circuit will be connected to the concrete plates, and a corona discharge will flow from the suspended anodes to the concrete cathodes.

Smoke exhausted from the boiler plant will pass between the concrete plates, and the suspended ash will be ionized by the corona discharge and deposited on the concrete plates, whence it will be removed periodically by mechanical means, dropping into hoppers below. Periodic removal from the hoppers will complete the process.

By means of a number of taps in the low-voltage winding of each transformer, it will be possible to select the best voltage at which the precipitators will operate. These taps will provide, besides the 75,000 volts, voltages of 70,000, 65,000, and 55,000.

Megohm Meter Effectively Registers Insulation

The megohm insulation meter shown in the illustration has recently been placed on the market by the Martindale Electric Co., Cleveland, Ohio. This meter weighs only 11 lb. and the readings obtained in testing equipment are said to be independent of the speed at which the generator in the meter is driven. The scale of the instrument, which is graduated to read directly in ohms or megohms, has a range from 200 ohms to 100 megohms. It is claimed that readings can be obtained instantaneously.

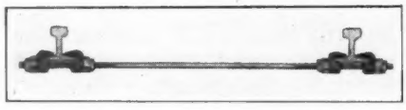
A meter for measuring insulation

Simplicity and Service in Track Braces

It is often a problem to hold a track to the desired gage on short curves over which heavy traffic moves, or where the track is laid through swampy ground, on account of water-soaked ties. To help improve service when these conditions are present, the T. H. Edelblute Co., Pittsburgh, Pa., has developed the Anchor track brace. This is a simple device that can be installed in a track in a few minutes by a man with a wrench. One size of this track brace will fit any rail up to 60 lb. in weight. Another brace is made for railroad sidings.

Stiffening of the switch is effected here by the track brace

According to the manufacturer, these braces are time savers for moving traffic after a wreck which has torn up or spread the track, because they are easily installed and few are necessary.



This track brace will grip six sizes of rail

New Welding Controller Has Wide Current Range

In announcing the Mann master controller it is the intention of the Electric Welder Controller Co., Pittsburgh, Pa., to eliminate some of the difficulties of electric-arc welding. From the operator's standpoint, the company states, this new device relieves the physical effort necessary in maintaining a correct welding arc under all conditions, especially those that arise in overhead, corner and gap welding. This is accomplished by means of increasing the flexibility of the arc a possible 15 to 30 per cent, depending upon the character of the arc produced by the machine in question.

From the quality standpoint it is claimed that the device enables the operator to produce a clean smooth weld and in addition to this characteristic it eliminates a large majority of the globules of metal being thrown from the arc to the surrounding plate. It also is effective in preventing pores and pinholes.

Another merit claimed for this controller is its current range which makes it possible to decrease the current at will from the maximum that the device will take to as low as 10 amp. without decreasing the voltage which is necessary in maintaining a flexible arc. The design of this controller is such that in numerous instances it is possible to eliminate control apparatus such as grids and resistance wire and still obtain a more flexible arc by means of the combined choke reactor than is usually possible with higher voltage. This, in brief, means that it will decrease the load on the welding generator by cutting down the voltage and raise the current thereby to a value equal in total watts to the higher voltage system. This also means that it raises the current capacity of the welder.

Filter Increases Dielectric Strength of Oils

To increase the dielectric strength of oils is the purpose of the Diskelectro oil filter now being manufactured by the S. F. Bowser Co., Fort Wayne, Ind. This device uses the principle of "edge" filtration between thin discs of metal. The distance is infinitesimal. Uniformity of spacing has been achieved by electro-depositing metal projections on the discs.

The low surface tension of oil permits of its passage between discs, but the high surface tension of the water globules prevents their passage through the same space.

The Diskelectro transformer and switch oil filter is made in three sizes; No. 1 has a capacity of from 75 to 100 gal. per hr., No. 2, 175 to 200 gal. per hr., and No. 3, 350 to 400 gal. per hr.

Perfected Air-Cooled Arc Welder Being Made

Another step in the progress of electric-arc welding is marked by the perfecting of an air-cooled alternating-current welding machine, designed to weld steel and cast iron and built for both light and heavy duty. This machine, now being manufactured by the Monarch Electric Welder Co., Des Moines, Iowa, was invented after seven years of experiment by Ralph and Earl Brummett of Des Moines.

It is claimed that this welder is self-cooling and cannot be overheated by constant operation. Another feature, it is stated, is the economy of maintenance, as its operation costs only 15c. per hour. The maximum current capacity of the Monarch welder is 1½ kw., operating on 110- or 220-volt power circuits. The adjustable amperage is between 20 and 170 amp.

This welder is a heavy-duty machine but is also adapted to lighter work, as its amperage may be increased or diminished at the operator's will.

Trade Catalogs

Cement—General Refractories Co., Philadelphia, Pa. "Grefco" high-temperature cement. Eight pages.

Diamond Drill—Sullivan Machinery Co., Chicago, Ill. Class "N" portable or mounted diamond core drill for deep structure testing in oil-field work. Three pages.

Material Handling—Stephens-Adamson Manufacturing Co., Aurora, Ill. General catalog No. 30, complete in its listing of S-A machinery, standard and special, as designed and manufactured for material handling purposes. The catalog contains 960 pages and is illustrated.

Market and Financial News

February Mining Dividends More Liberal

Increased Payments by A. S. & R. and Wright-Hargreaves With Resumption by Freeport Texas, Swell Total

By E. H. Robie
Assistant Editor

THE SECOND MONTH of the year is not so popular as is January or March for the payments of quarterly mining dividends, but the total is comparative with November, 1926, and with February of a year ago. So judged, the total for the month just ending, as shown in the accompanying table, shows a healthy increase, being about $900,000 more than was paid in November, 1926, and $1,500,000 more than was paid a year ago.

The American Smelting & Refining Co. is now paying $2 a quarter instead of $1.75. This is the highest dividend that this company has ever paid since dividends were begun in 1904. Recent news dispatches stated that the Garfield smelter of the company has been breaking all records for the production of blister copper at that plant, operating at the rate of about 15,000 tons a month. The labor efficiency is indicated by the fact that only 1,200 men are employed, compared with 2,000 during the peak of capacity during the World War.

The Freeport Texas Co. again enters the list of dividend payers, with a quarterly payment of 50c., the first since Nov. 28, 1919. Its stock has recently advanced greatly, so that the yield is only 4½ per cent. There is considerable curiosity as to why the shares should sell so high, as recent earnings statements would apparently not justify present prices.

Wright-Hargreaves paid an extra dividend as a result of the final balance on the 1926 operations. An extra was also declared a year ago, but at that time the total came to only 10c. a share, whereas it was 15c. this month. The regular dividend is 7½c. a share quarterly.

Market followers evidently expect great things of the leading Kirkland Lake gold stocks; Wright-Hargreaves is yielding only 3.7 per cent, Teck-Hughes 1.6 per cent, and Lake Shore about 2.7 per cent. Dividends would have to be amplified considerably, and extended over a long period of years, to justify present market prices. This, however, is just what is likely to happen. Market valuations of Lake Shore are now $36,500,000; of Teck-Hughes, $30,000,000; and of Wright-Hargreaves, $28,000,000. Are they worth that much?

Anaconda is expected in some quarters to increase its dividend before the end of the year, as it is estimated to be earning something like $7 annually, compared with dividends of $3 now being paid. The increase, should it be made, would probably be to $4.

Colorado Fuel & Iron, in which John D. Rockefeller is said to own a controlling interest, continues to pay dividends on its preferred stock only, though it is reported to have earned $9 a share on its common stock last year and to be operating even more profitably now. Costs will be cut down materially by the use of gas as fuel and by the utilization of electricity. This company, which is one of the oldest steel companies in the country, being thirty-three years old, has had many ups and downs.

Profits of the Chief Consolidated company, operating in Utah, were insufficient during the last quarter of 1926 to justify the payment of the regular dividend due in February.

Mining Dividends for February, 1927

Companies in the United States	Situation	Per Share	Total	Per Cent Annual Yield
American Smelting & Refining	Various	$2.00 Q	$1,219,960	5.2
Anaconda Copper, c, z, l, s	Various	0.75 Q	2,250,000	6.5
Cardiff Mining & Milling	Utah	0.10	50,000	....
Colorado Fuel & Iron pfd	Various	2.00 Q	40,000	6.8
Freeport Texas, s	Texas	0.50 Q	364,726	4.5
General Development, h	Various	0.25 Q	30,000	....
Gladstone Mountain, l	Wash.	0.005 M	6,609	21.4
Homestake Mining, g	S. D.	0.50 M	125,580	†11.6
International Nickel pfd., n. c	Ont., W. Va.	1.50 Q	133,689	†5.7
Isle Royale Copper	Mich.	0.50 SA	75,000	10.0
Miami Copper	Ariz.	0.375 Q	280,168	9.7
New Cornelia Copper	Ariz.	0.50 Q	900,000	9.00
New Jersey Zinc	Various	2.00 Q	981,632	j 6.4
U. S. Steel pfd	Various	1.75 Q	6,305,497	5.4
United Verde Extension, c	Ariz.	0.75 Q	787,500	12.4
Vanadium Corporation	Various	0.75 Q	282,853	j10.1
Companies in other countries				
Amparo Mining, g, s	Jalisco	0.02 Q	40,000	....
Cerro de Pasco, c, s	Peru	1.00 Q	1,122,842	6.6
Hollinger Consolidated Gold	Ont.	0.10 4 wks.	492,000	5.8
Teck-Hughes Gold	Ont.	0.05 SA	237,357	1.6
Wright-Hargreaves, g	Ont.	0.15 QX	412,500	j 3.7
Total and average			$16,137,913	7.9

c, copper; z, zinc; l, lead; s, silver; h, holding company; g, gold; n, nickel; s, sulphur; Q, quarterly; M, monthly; SA, semi-annually; X, includes extra; j, based on dividends for the last twelve months.

Sharpe Sees Production Cost as Brake on Zinc Output

A month ago, says A. J. M. Sharpe, honorary foreign correspondent of the American Zinc Institute, in his current review of the zinc situation, I mentioned with what concern marketing factors were viewing the expansion in production. After the publication of the United States statistics for December there came the announcement that the Belgian production for the same month —17,366 metric tons—constituted a record, for the last twelve years at any rate. The market thus was affected sentimentally, and prices steadily gave way, until at the time of writing (Feb. 1) zinc is selling in London at under £29.

The safety valve as regards world output is the cost of production. This, says Mr. Sharpe, necessarily varies in different countries, and even, of course, among individual smelters. There are few smelting companies in Europe which possess their own mines. Indeed, even the big Vieille Montagne company is unable to produce all the ore it requires for its smelting works. Consequently, it is possible to arrive fairly closely at the selling price of slab zinc which would automatically force a decline in production. The economic factor, as a matter of fact, lies between £26 10s. and £28, varying with working conditions at different smelters, and a fair average would probably be £27 5s. Obviously, the shoe will first start to pinch the ore producer, inasmuch as the prices paid for calamine and blende are governed month by month by the market price of G.O.B. zinc in London. This factor has, therefore, to be taken into consideration in fixing the basis cost of producing zinc in Europe at £27 5s. as aforesaid. The smelters who are dependent upon purchased ores for their raw requirements are not waxing rich, as their profit is limited by what they can save out of £6.56 after payment of smelting, transport, and marketing charges. That figure is based on zinc selling at £32 and is, of course, reduced now that zinc has further depreciated to under £29.

It may take two or three months for the industry to readjust its position in accordance with the low level of prices now ruling. The present is no time for overproduction.

The Belgian output for 1926, of 204,200 metric tons, is the highest since 1913, but, unless there is a substantial recovery in market prices in the present year, it is extremely unlikely that Belgium will produce as great a quantity in 1927. Such unlikelihood is emphasized by the lessening in the English requirements of Continental metal, owing to the resumption of smelting in Great Britain. The British smelters, it will be remembered, are in the happy position of operating on

terms which really amount to a subvention, as their ore is supplied by the government in the form of Australian concentrates at a landed price varying with the monthly London quotation for slab zinc, but well below what the continental smelters have to pay for similar grades. Smelting in the British works is now well under way again, and the output in January of 3,200 tons will gradually expand to 4,000 tons or so monthly.

Mr. Sharpe estimates world stocks of zinc on Feb. 1, as:

Country	Metric Tons
United States	27,200
Canada	3,300
Australia (including unsold shipments afloat)	2,400
Germany-Poland	9,000
Belgium	4,200
France	1,200
Great Britain	1,300
Scandinavia	200
Far East	500
Elsewhere	1,500
Total	50,800

Better Metal Buying Ahead in Germany

Imports in 1926 Declined—Combinations of Producers and Consumers Progress—Expansion in Domestic Zinc Output Looked For

By Dr. James Rubinfeld
Special Correspondent at Berlin

THOUGH there has been a definite improvement of economic conditions in Germany in the second half of the last year, the balance of imports and consumption of metallic rawstuffs in 1926 lags far behind when compared with 1925. According to official statistics, metal imports have been as follows:

Imports of Metals, in Metric Tons

	1926	1925		1926	1915
Copper	146,511	210,957	Nickel	1,847	2,521
Lead	93,264	137,745	Antimony	2,280	2,330
Zinc	100,059	105,475	Aluminum	5,527	10,719
Tin	10,646	12,944	Quicksilver	800	791

Although it may appear paradoxical, in my opinion the formation of the Copper Exporters, Inc., has had indirectly the effect of minimizing German forward buying abroad. Those interested held that in view of the stabilization aims of producers there would be no or at least little bull speculation, so it would be easy enough to procure metal when wanted. But as London dealers for some time have been underbidding the Exporters c.i.f. quotations in this market, consumers have become extremely cautious. On the other hand, German metal manufacturers are by no means as busy as a great number of other German industries, especially those of iron and steel, which could profit by the event of the British coal stoppage and its sequels. Orders of the Federal Railways for new cars and locomotives as well as for electrification schemes, with the exception of the Berlin urban railway, which is making headway, are coming along slowly. The brass trade here is suffering most from cut-throat competition at home and abroad.

Under the auspices of the American Copper and Brass Research Association, whose manager, W. A. Willis, was present at the ceremony, a similar institute ("Deutsches Kupfer-und Messinginstitut") has been organized in Berlin for the purpose of popularizing the manifold uses of copper and brass in this country, which to some extent have been lost sight of by the public in the stress of war and inflation times. It remains to be seen whether the new "institute" will reach its aims by simple propaganda work like the American.

Producers of aluminum here are following a policy of cheapening the light metal, and it is to be traced especially to the initiative of German producers that the international cartel was formed some months ago, and that, indirectly, the Aluminum Co. of America must somehow make some price concessions to American consumers lest more of the European metal find its way to the Atlantic shores of the United States. At least 25 per cent of the German aluminum production went to America last year.

As for tin, the tin-plate makers could of course make some hay because of the coal entanglements of South Wales. Tin-plate exports in 1926 were nearly double those of the preceding year. A barrier to the bronze and babbitt consumption has been the shrinkage of business in the machine and car trades. I venture to think that no increase of tin consumption above that of 1926 is reasonably to be expected in the present year. The contrary, however, is the case with zinc and lead, because a strong revival of the long-neglected building trade is under way. Experts are justly estimating the normal yearly requirements of Germany for zinc at 250,000 tons at least, but in view of the depression of the brass business this rate is of course not yet being reached. On the other hand, the galvanizers are doing a good business with consumers, and prices are well held by dealers' unions or cartels. The Raw Zinc Syndicate of Kattowitz, which was dissolved at the close of 1926, is to be reorganized. The Giesches heirs, with whom the Anaconda-Harriman group participates to the extent of 51 per cent; the Silesian Company for Mining & Smelting at Lipine; the Hohenlohe concern; the concerns of Count and Prince Henckel von Donnersmarck (notwithstanding the predominating French and English as well as Belgian participations), are now negotiating the renewal of a pure Polish syndicate.

It is hoped that early in the current year zinc smelting of domestic ores will exceed 100,000 tons and that a good deal of home production will consist of electrolytic zinc within the next few years.

There are rumors that the Harriman interests have finally acquired a substantial block of shares of Stolberg, with a view to gaining a greater share of the world market on behalf of the Anaconda company. The same condition is believed to have been attained with regard to the Hohenlohe company. In the supposed syndicate the trading firms of the Metallgesellschaft, Beer Sondheimer, and Aron Hirsch und Sohn will have no part whatever and will not handle the zinc, as before.

A quiet tone for lead was caused by heavy influxes of the metal into the port of Hamburg from Australia, Mexico, and even from Burma. German dealers are selling short for months ahead in London, and are thus overtopping the depression already existing in this field. Although the cable and storage-battery makers are carrying on, nobody will buy except on a hand-to-mouth basis.

A general movement to combine similar manufacturing concerns should have remarkable effects within the next few months or years. Already three known Rhenish-Westphalian copper, brass and nickel rollers have decided to combine. A great deal of similar negotiations are moving forward, and results may be expected ere long. The trend to combine is the result of a determination to cut down overhead charges and to "rationalize," in order to produce and to sell more cheaply than is possible now.

Statistical Notes

Hecla Mining Co., operating in the Coeur d'Alene district, in Idaho, has reduced its dividend rate from 50c. per share to 25c. Dividends are paid quarterly, the first at the reduced rate being due on March 15. The reason for the decrease, according to the directors, is the lower price for lead. The company is daily producing about 1,000 tons of ore containing silver as well as lead. It is estimated that the Hecla company will be called upon to furnish about $700,000 during the next year to finance the building of the new electrolytic zinc plant for the treatment of ores from the Sullivan Mining Co.'s Star mine. The Hecla and Bunker Hill & Sullivan companies are equal owners of the Sullivan company.

Calumet & Hecla Consolidated Copper Co., operating in the Michigan copper district, converted a net loss during 1924 and 1925 into a profit as a result of its operations during 1926. The following figures summarize the financial results:

Year	Gross Income	Expense, Taxes, Depletion	Net Profit
1924	$9,580,741	$11,215,179	(a)$1,634,438
1925	14,450,830	14,887,506	(a)436,676
1926	14,479,179	12,978,861	1,500,318

(a) Loss.

World's Zinc Production for January, 1927, according to the A.B. of M.S., was 120,450 tons, compared with 118,591 in December. This establishes a new high record for the industry.

Eagle-Picher Lead Co. for year ended Dec. 31, 1926, reports a net profit of $1,824,818 after charges and federal taxes. This compares with $2,297,651 in 1925.

The Market Report

Copper and Zinc Prices Stiffen

Good Volume of Business in Domestic and Foreign Markets—Lead Quiet and Unchanged

New York, Feb. 23, 1927—In spite of the holiday the week has been active in the copper and zinc markets, and prices are distinctly better than a week ago. Strength in the London market, and reports of curtailment in production rates, have been responsible for the improvement. In zinc, speculative buying rather than heavy buying on the part of consumers has been the feature. Prices for lead have fluctuated very little, with the market generally quiet. Straits tin passed 70c. for prompt delivery in the domestic market on Saturday and Monday, but is a trifle easier today. Silver has ranged between 57⅛c. and 58⅛c., with no definite tendency apparent.

Copper Sellers at 13⅛c.

Only one comparatively small sale of copper brought less than 13c. delivered in Connecticut during the week ending today. The total volume of sales was above the average, though most of the business was confined to Saturday and Monday, when 13c. in the East and as high as 13¼c. in the "Middle West" were realized. Today all of the important sellers are at 13⅛c., though the market has a tired aspect after the active selling of the last three weeks. Buyers apparently are not in serious need of metal, and some of them feel that the price has gone up too rapidly. Sellers, on the other hand, are in a comparatively easy position and argue that the price is merely returning to a reasonable level after the slump to 12½c. Foreign business by the export association was excellent at 13.375c., and on Tuesday the price was raised to 13.45c. The American Brass Co. on Monday increased its prices for copper and brass and other alloy products by ¼c. per pound, putting them on the basis of 13⅛c. copper. Probably the most favorable factor in the situation is the policy of curtailed output, which, according to all indications, will be actual rather than merely a talking point.

Lead Quieter

The volume of lead sales in the week ending today was not nearly so large as in either of the two preceding weeks, though the total was satisfactory, considering the holiday. Monday was perhaps the most active day, with most of the business to Middle Western buyers. The American Smelting & Refining Co. continued to quote the Eastern market on the 7.40c. New York basis, and apparently made free offerings at that level for February and March shipment. Other sellers booked small tonnages at from 7.50 to 7.55c. for positions further forward in most instances. Supplies of desilverized lead seem more plentiful than those of Missouri lead.

In the Middle West, the leading sellers generally held at 7.30c., St. Louis, though a slight advance on this has been obtained in some sales. Chicago has ruled at 7.40c. Sales by Middle Western producers have recently been somewhat greater than production, which has made for increased firmness in their attitude toward the market.

Consumers are pretty well supplied for February, most of the demand being for March shipment. The chief buyers have been manufacturers of blue lead products, cable and ammunition manufacturers, and to some extent paint and battery makers, though the last-named are not yet very heavy takers.

Curtailment Helps Zinc

Buying by speculative interests that are apparently bullish on zinc has been a feature of the week. Producers of concentrate in Joplin were able to increase the price from $43 last week, and with production continuing on a curtailed basis, zinc sellers are looking for better prices. London showed improvement until Tuesday, after which there was some decline. High-Grade zinc is dull at 8½c. delivered in the New York district.

Tin Above 70c. Again

The tin market has been spotty, with some consumer buying on the rise, but dealers have been the principal ones interested in near-by metal. Spot and prompt Straits tin was in unusual de-

Daily Prices of Metals

Feb.	Copper	Tin		Lead		Zinc
	Electrolytic, N. Y	99 Per Cent	Straits	N. Y.	St. L.	St. L.
17	12.775	66.625	69.50	7.40	7.30	6.65@6.675
18	12.775	66.75	69.625	7.425	7.30	6.65@6.85
19	12.775	67.25	70.375	7.425	7.30	6.775
21	12.775	67.50	70.375	7.425	7.30	6.85
22	Holiday	.....	.....	.....	.....	.....
23	12.90	67.00	69.875	7.40	7.30	6.80@6.825
Av.	12.800	67.025	69.950	7.415	7.300	6.770

Average prices for calendar week ending February 19, 1927, are: Copper, 12.746c.; 99 per cent tin, 66.521c.; Straits, 69.396c.; N. Y. lead, 7.421c.; St. L. lead, 7.308c.; zinc, 6.690c.; and silver, 57.417c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; i.e., delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard.

Quotations for copper are for ordinary forms of wire bars, ingot bars, and cakes. For ingots an extra 0.05c. per pound is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Feb.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3 M
17	53 7/8	54 1/2	61	306 1/4	295 1/2	27 3/16	27 1/2	29 3/4	29 15/16
18	53 7/8	54 7/16	60 3/4	308	297	27 5/8	27 15/16	30 1/8	30 1/4
21	55	55 1/2	61 3/4	311 1/4	300 1/4	28 1/8	28 7/16	30 7/8	30 15/16
22	55	55 1/2	61 3/4	308 1/2	298 1/2	27 7/8	28 1/4	30 3/4	30 5/8
23	55 1/8	55 7/8	61 3/4	307 3/4	299	27 7/8	28 3/16	30 1/4	30 1/2

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Feb.	Sterling Exchange "Checks"	Silver		Gold London	Feb.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
17	4.84 1/2	57 3/4	26 7/8	84s10½d	21	4.84 9/16	57 3/8	26 3/4	84s11d
18	4.84 9/16	57 7/8	26 1/2	84s10½d	22	Holiday		26 9/16	84s10¾d
19	5.84 9/16	58 1/2	27 3/16	.....	23	4.84 9/16	57 1/2	26 3/4	84s11½d
					Avg.		57.800		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

mand on Saturday, and the price advanced above 70c. even without the aid of the London cables. April and May tin has ruled from 2 to 3c. under prompt Straits.

Silver Quiet and Uncertain

During the last week, India has bought silver and China has sold as well as bought, according to cable advices from London. In the local market moderate buying orders have been present from both of the above-named sources. In general conditions are quiet, with no definite tendency apparent, although the state of affairs in Shanghai exerts a controlling influence over the market.

Mexican Dollars (old Mexican pesos): Feb. 17, 43⅞c.; Feb. 18, 44c.; Feb. 19, 44⅛c.; Feb. 21, 43½c.; Feb. 22, holiday; Feb. 23, 43⅝c.

Lire Higher

Closing cable quotations on the principal foreign exchanges on Monday, Feb. 21, were: francs, 3.91¾c.; lire, 4.42c.; and marks, 23.705c. Canadian dollars, $\frac{5}{32}$ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum — Domestic or imported, 98 or 99 per cent grade, 26c. per lb. London, 98 per cent, £105@£107 per long ton for domestic consumption.

Antimony—Per lb., duty paid, New York: Chinese brands, spot, 14½@14c.; April prices about ⅛@¼c. less; Cookson's "C" grade, spot, 18c. Market dull; better sentiment owing to situation in China. Needle antimony nominally 8c. for lump and 10c. for powdered. White oxide, 16½c.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c.@65c. Increased consumption has stiffened price. London, Australian metal selling freely at 1s. 10d.

Iridium—Per oz., $115@$120 for 98@99 per cent sponge and powder.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton, according to quantity.

Palladium—Per oz., $58@$62. Small lots bring up to $68. Dull. Pure metal as a constituent of crude platinum, $55@$59 per oz. London, £11@£12, nominal.

Platinum — Official price quoted by the leading interest on miscellaneous orders for refined metal, $108. Open market cash sales of large lots, in New York, $101@$104. Pure metal as a constituent of crude platinum, $100@$101. Market remains dull.

London, £22 per oz. for refined and £18½@£19½ for crude. Dull.

Quicksilver—Per 75-lb. flask, $102. Market firm but quiet. San Francisco wires $101, steady. London, £17½ for spot.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Feb. 5.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 36@38c. Caucasian (washed), 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the Feb. 5 issue.

Tungsten Ore — Per unit of WO_3, N. Y.: Wolframite, $10.75@$11; Western scheelite, $11.25@$11.50. Dull; prices largely nominal.

Chrome, Iron, Molybdenum, Tantalum, Titanium, Uranium, and Vanadium Ores are unchanged from quotations in the Feb. 5 issue.

Zinc Blende Advancing—Lead Ore Unchanged

Joplin, Mo., Feb. 19, 1926

Blende	Per Ton
High	$48.60
Premium blende, basis 60 per cent zinc	$45.00@47.00
Prime Western, basis 60 per cent zinc	44.00@45.00
Fines and slimes, 60 per cent zinc	43.00@39.00
Average settling price, all zinc	42.48
Galena	
High	$94.70
Basis 80 per cent lead	90.00
Average settling price, all lead	93.31

Shipments for the week: Blende, 10,518; lead, 1,494 tons. Value, all ores the week, $585,710.

Settlements are reported by sellers on a level above $48 per ton, and price quotations are partly based on this information because it is authentic, though buyers decline to acknowledge a basis higher than $44 Prime Western and $46 premium.

Actual settlement figures give $48.60 as a high settling price, and this could not be paid upon a basis under $47 per ton. Buyers found no easy task in filling orders on a $44 basis Prime Western, and while $45 is disclaimed it will be paid if all orders are filled today.

Producers who could not afford to hold their ore have sold ahead and accepted advances in order to keep mills running, and the ore in the bins is all in the hands of companies strong enough to hold for a suitable basis. With production costs at $45.26 per ton, no large quantity will be released under a $46 basis Prime Western.

Lead output has dropped noticeably, and a fourth of that being produced is withheld from the market, lowering shipments 1,200 to 1,500 tons less than the same weeks of last year.

Platteville, Wis., Feb. 19, 1927

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$45.75
Lead Ore	
Lead, basis 80 per cent lead	$95.00

Shipments for the week: Blende, 1,385 tons; lead, 120 tons. Shipments for the year: Blende, 9,796; lead 340 tons. Shipments for the week to separating plants, 2,419 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fullers Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Feb. 5 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3¾c. per lb. Quiet.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Feb. 5 issue.

Ferro-Alloys

Ferromanganese—Domestic and foreign, 78@82 per cent, $100 per long ton, furnace or duty paid, for delivery during first half of 1927. Spiegeleisen, 19@21 per cent, $36@$37, f.o.b. furnace; 16@19 per cent, $34@$35.

Ferrotungsten—$1@$1.05 per lb. of W contained, f.o.b. works. Market spotty.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the Feb. 5 issue.

Metal Products

Rolled Copper—Sheets, 21¾c.; wire, 15c., f.o.b. mill.

Lead Sheets—Full rolled, 11c. per lb.; clipped, 11¼c.

Nickel Silver—28¾c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal—Dimension sheets 19¼c. per lb.; rods, 16¾c.

Zinc Sheets—11c. per lb., f.o.b. mill.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and **Zirkite** are unchanged from quotations in the Feb. 5 issue.

Steel Prices Sag—Pig Iron and Coke Firmer

Pittsburgh, Feb. 22, 1927

Since early in January there has been a week-to-week increase in the volume of steel buying, with production closely following the lead, as nearly all buying has been for prompt shipment. Individual consuming lines are moderately busy. Freight-car buying and fabricated structural steel contracting have run higher since Jan. 1 than the average of last year.

Steel prices have shown a little further softening in spots, galvanized sheets being off $2 a ton, to 3.65c., and hot-rolled strips in large tonnages have gone at 1.90c., or about $2 a ton decline. Bars, shapes and plates are at their levels of a week ago.

Pig Iron.—The Valley market continues dull, consumers showing no interest. Prices have held firmly, at $19 for bessemer, $18 for basic and $18.50 for foundry, f.o.b. furnaces.

Connellsville Coke.—The spot market is firmer, on light offerings, demand being of rather small proportions. Blast furnaces are not buying at all. Spot furnace, $3.35@$3.50; spot foundry, $4.25@$4.75.

Current Prices of Mining Supplies

Rise and Fall of the Market

DECLINES predominate in the current market for mining supplies. The downward tendency is by no means marked and is consistent with the movement in commodities in general. The principal items affected are steel sheets, shapes and plates; cast-iron pipe; mine timbers; portland cement; and litharge.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.15@2.25	$3.60	$3.50	$3.75	$3.89
Black					
No. 24	3.00@3.05	4.45	3.95	4.70	4.35
Galvanized					
No. 24	3.70@3.80	5.25	4.80	5.25	5.10

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots:

	Pittsburgh Current	Pittsburgh One Year Ago	Birmingham	Chicago
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00
Standard openhearth rails	43.00	43.00	43.00	43.00

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	$2.80–2.90	$2.80	$3.55	$3.65	$4.35	$3.00
Track bolts	3.90–4.25	3.90@4.25	4.55	4.60	5.85	3.90
Standard section angle bars	2.85	2.75	3.40	3.75	3.60	4.15

STRUCTURAL MATERIAL—Following are base prices in carload lots, f.o.b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. in less than carload lots, from warehouses at places named:

	Pittsburgh, Mill	Birmingham Mill	New York	Dallas	St. Louis	Chicago	San Francisco
Beams, 3 to 15 in.	$1.90	$2.05	$3.34	$4.15	$3.25	$3.10	$3.00
Channel, 3 to 15 in.	1.90	2.10	3.34	4.15	3.25	3.10	3.00
Angles, 3 to 6 in., ¼ in. thick	1.90	2.10	3.34	4.15	3.25	3.10	3.00
Tees, 3 in. and larger	1.90	2.10	3.34	4.15	3.35	3.10	3.00
Plates ¼-inch thick	1.80@1.90	2.00	3.34	4.15	3.25	3.10	3.00

WIRE ROPE—Discounts from list price, f.o.b. New York and east of Missouri River, on regular grades of bright and galvanized are as follows:

Cast steel round strand rope	20%
Galvanized steel rigging and guy rope	7½%
Round strand iron and iron tiller	5%
Plow steel round strand rope	35%
Special steel round strand rope	30%
Galvanized iron rigging and guy rope	+12½%

	New York	Cleveland	Chicago
Drill Rod (from list)	60%	55%	50%

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

	Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv.
BUTT WELD	..1 to 3	62	50½	1 to 1½	30	12
LAP WELD	2½ to 6	59	47½	3 to 6	28	13

STEEL PIPE—From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
2½ to 6 in. lap welded	48%	51%	46%

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York Current	New York One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
6 in. and over	$47.60	$50.60@52.60	$37.00 base	$45.20	$43.60	$47.00

NUTS—Semi-finished, ½x½-in., 2c. each. Discount 70% for ⅜-in. and smaller; 65% for ½-in. and larger. Case hardened, 6c. each, less 50%.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York Current on Trucks	New York One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.1027	$0.1112	$0.076	$0.105	$0.068	$0.108	.....
6x12x12	.1541	.1667	.104	.....	.09	.156	$0.252*
8x12x12	.1926	.2084	.142	.205	.126	.244	.312†

* 10x12x12; † 12x12x12.

MACHINE BOLTS—½x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%.

LUMBER—Prices of rough Douglas Fir No. 1 common, in carload lots to contractors at yards in San Francisco.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00

Wholesale prices to dealers of long leaf yellow pine. To contractors in New York City, delivered from lighters or cars to job, $5@$10 additional.

	New York 20 Ft. and Under	New York 22-24 Ft.	Chicago Up to 20 Ft., Pine	Chicago Up to 32 Ft., Fir
3x4 to 8x8	$42.00@44.00	$43.00@45.00	$39.00	$40.00
3x10 to 10x10	49.00@51.00	50.00@52.00	46.00	40.00
3x12 to 12x12	56.00@58.00	57.00@59.00	56.00	40.00

Other Cities	8 x 8-In. x 20 Ft. and Under Pine	Fir*	Hemlock	Spruce	12 x 12-In. 20 Ft. and Under Pine	Fir*
Boston	$48.50	$48.00†	$50.00	$51.00	$58.50	$58.00†
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Denver	.....	33.75	32.75	32.75	.....	32.75
Minneapolis	42.50	39.25	34.50	.....	45.00	39.25
Kansas City, Mo.	42.50	40.75	.....	.....	57.50	40.75
Philadelphia	54.00	38.00	38.00	45.00	65.00	38.00

*Douglas fir. † Prime.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2.65	$3.05	$3.50	$4.25	$2.85	$4.95
Cut	2.80	....	5.00	5.00	3.00	5.00

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots *without bags*. Cash discount not deducted.

	Current	One Month Ago	One Year Ago
New York, del. by truck	$2.35@2.50	$2.50@2.60	$2.50@2.70
Chicago, f.o.b.	2.05	2.10	2.10
Cleveland, f.o.b.	2.24	2.29	2.29

LIME—Warehouse prices, New York quotes 280 lb. net; Chicago, 180 lb.:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per Barrel Finishing	Lump, per Barrel Common
New York	$18.20	$11.00	$3.50	$2.10@$3.00
Chicago	20.00	18.00	....	1.50

LINSEED OIL—These prices are per gallon:

	New York Current	New York One Year Ago	Chicago Current	Chicago One Year Ago
Raw in barrel (5 bbl. lots)	$0.84	$0.88½	$0.85	$0.90

WHITE AND RED LEAD—In 100-lb. kegs, base price in cents per pound:

	Dry Current	Dry 1 Yr. Ago	In Oil Current	In Oil 1 Yr. Ago
Red	15.25	15.25	16.75	16.75
White	15.25	15.25	15.25	15.25

HOSE—Quotations at New York warehouses:

Fire Protection 50-Ft. Lengths

Underwriters' 2½-in. coupled, single jacket (net) ..... $0.68 per ft.

Air—Best Grade

¾-in., per ft. ..... 3 ply $0.34 4 ply $0.42

Steam—Discounts from List

First grade .... 40% Second grade .... 40–5% Third grade 50%

RUBBER BELTING—List price 6-in., 6 ply, $1.83 per lin.ft. for rubber transmission belting.

Best grade ..... 50% Second grade 50–10%

LEATHER BELTING—List price, 24c. per lin.ft. per inch of width for single ply at New York warehouses:

Grade	Discount from list
Medium	40–5%
Heavy	30–10%

RAWHIDE LACING—For cut, best grade, 50%, 2nd grade, 60%. For laces in sides, best, 41c. per sq.ft.; 2nd, 37c. Semi-tanned: cut, 50%; sides, 41c. per sq.ft.

PACKING—Prices per pound:

Rubber and duck for low-pressure steam, ¾ in.	$1.05
Rubber sheet	.60
Rubber sheet, wire insertion	.85

MANILA ROPE—Per lb., ¾-in. and larger, 1,200-ft. coils.

Atlanta	$0.30	New Orleans	$0.21
New York	.24½	Seattle	.22
Chicago	23	San Francisco	.22½

EXPLOSIVES—Prices per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265	$0.2875
Minneapolis	.1917	.2123
Denver	.2025	.2275
Seattle	.165	.19
Cincinnati	.22	.245
New Orleans	.235	.26
San Francisco	.1625	.1925

FLOTATION OIL—

Pine tar, 50 gal. bbl., gross weight 500 lb., f.o.b. New York, carload lots, per gal. $0.41

CHEMICALS—

Zinc dust, 550 lb. casks, f.o.b. works, per lb.	$0.10@.10½
Litharge, casks, f.o.b. works, per lb.	.10½
Sodium cyanide, 220 lb. single case lots, f.o.b. works, per lb.	18@.22
Calcium carbide, in drums, f.o.b. works, per lb.	.05½@.06

Mining Stocks—Week Ended February 19, 1927

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	46⅞	45⅝	46⅛	Ja. 15, Fe. 21	Q 0.75
Arcadian Consol.	Boston	*50	*50	*50		
Ariz. Com'l	Boston	8⅛	7⅝	7⅞	Ja. 7, Ja. 28	0.50
Calaveras	N. Y. Curb	1⅛	1⅛	1⅛		
Calumet & Arizona	New York	67	65⅝	66⅛	De. 3, De. 20	Q 1.50
Calumet & Hecla	Boston	15⅜	15⅛	15⅛	Fe.28, Ma.15	Q 0.50
Cerro de Pasco	New York	61⅞	60⅝	61	Ja.13,Fe.1, Q	1.00
Chile Copper	New York	36⅛	35	35⅞	Ma.4,Apr.1, Q	0.62½
Chino	New York	...	...	22⅛		
Con. Coppermines	N. Y. Curb	2⅛	2⅛	2⅛		
Copper Range	Boston	13⅜	13	13	May, 1926	1.00
Crystal Copper	Boston Curb	*27	*25	*25		
East Butte	Boston	2⅛	2⅛	2⅛	Dec., 1919	0.50
First National	Boston Curb	...	...	*9	Feb., 1919	0.15
Franklin	Boston	*10	*5	*10		
Granby Consol.	New York	34⅜	33⅛	34⅛	May, 1919	1.25
Greene-Cananea	New York	32⅜	31⅛	32	Nov., 1920	0.50
Hancock	Boston	*50	*35	*35		
Howe Sound	New York	39⅛	37⅞	38⅛	De.31, Ja.15	Q 1.00
Inspiration Consl.	New York	23⅛	23	23⅛	De.16, Ja.3, Q	0.50
Iron Cap	Boston Curb	...	...	2		
Isle Royale	Boston	10⅛	9⅛	9⅛	Fe.4, Fe.19	Q 0.50
Jerome Verde Dev.	N. Y. Curb	...	...	*41		
Kennecott	New York	62⅛	60⅜	62⅛	Mar. 4 Apr. 1	Q 1.25
Lake Copper	Boston	1	*95	1	June, 1925	0.50
Magma Copper	New York	34⅛	33⅛	33⅞	Dec.1, Ja.15,	Q 0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Mass Consolidated	Boston	*35	*35	*35	Nov., 1917	1.00
Miami Copper	New York	15⅛	14⅛	15⅛	Fe.1, Fe. 15	Q 0.37½
Mohawk	Boston	40⅛	37	37	Ja.29, Ma.1	Q 1.00
Mother Lode Cos.	New York	4½	4	4⅛	De.10, De.31	SA 0.37½
Nevada Consol.	New York	14⅛	14	14⅛	De.15, De.31	Q 0.37½
New Cornelia	Boston	23	21⅞	22	Fe.4, Fe.21	Q 0.50
Noranda	N. Y. Curb	20⅛	20⅛	20⅜		
North Butte	Boston	2⅛	2⅛	2⅛	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*48	*48	*48	Se. 1, Se. 15	0.03
Old Dominion	Boston	13⅛	12	12	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†127	†124	...	De.24, Ja.3	Q 1.50
Quincy	Boston	16	14½	14½	Mar., 1926	1.00
Ray Consolidated	New York	14⅜	14⅛	14⅜	Ap.20, Ap.30	0.25
St. Mary's Min. Ld.	Boston	22⅛	20⅞	21	Fe.10 Ma.10	2.00
Seneca Copper	New York	3⅛	2⅞	3		
Shannon	Boston	*38	*25	*30	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	5⅛	5⅛	5⅛		
Tenn. C. & C.	New York	12⅛	11⅛	12⅛	Fe.28, Ma.15,	Q 0.25
United Verde Ex.	N. Y. Curb	...	...	24⅛	Ja. 6, Fe. 1	0.75
Utah Copper	New York	112⅛	112⅛	112⅛	De.15, De.31	Q 1.50
Utah Metal & T.	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Victoria	Boston	*75	*75	*75		
Walker Mining	Salt Lake	*84	*70	*74		
NICKEL-COPPER						
Internat. Nickel	New York	43⅜	41⅞	43⅜	De.16, De.31,	Q 0.50
Internat. Nickel, pfd.	New York	....	....	106	Ja. 13, Fe.1,	Q 1.50
LEAD						
Gladstone Mtn.	Spokane	*29⅜	*28	*29½	Fe. 1927	0.005
National Lead	New York	175⅛	166	174	Ma.11, Ma.31	Q 2.00
National Lead pfd.	New York	118⅛	118	118⅛	No.19, De.15	Q 1.75
St. Joseph Lead	New York	41⅛	40⅛	41	Jn.10, Jn.20,	QX 0.75
ZINC						
Am. Z. L. & S.	New York	10⅛	9⅛	10	May, 1917	1.00
Am. Z. L. & S, pfd.	New York	51⅛	48	51	Nov., 1920	1.50
Butte C. & Z.	New York	4⅜	3⅞	3⅞	De.9, De.24	0.50
Butte & Superior	New York	11⅛	10⅜	10⅜	De.9, De.24	Q 0.50
Callahan Zn-Ld.	New York	2	2	2	Dec., 1920	0.50
Eagle-Picher	Cincinnati	27⅛	26⅛	26⅛	Fe.15, Ma.1	Q 0.40
Eagle-Picher, pfd.	Cincinnati	...	...	100	De.31, Ja.15	Q 1.50
New Jersey Zn.	N. Y. Curb	188	187	187	Ja.20, Fe.10	Q 2.00
United Zinc	N. Y. Curb	...	...	55		
Yellow Pine	Los Angeles	*26	*26	*26	Dec. 1925	Q 0.04
GOLD						
Alaska Juneau	New York	2⅛	1⅞	2⅛		
Argonaut	Toronto	*42	*40	*40⅜		
Barry-Hollinger	Toronto	*68⅜	*60	*63		
Carson Hill	Boston	...	...	*20		
Consol. W. Dome L.	Toronto	*15	*12½	*13½		
Cresson Consol. G.	N. Y. Curb	2⅛	2 1/16	2⅛	De.31, Ja.10	Q 0.10
Crown Reserve	Toronto	9⅜	8⅛	9⅜	Jan., 1917	0.05
Dome Mines	New York	9⅜	9⅛	9⅜	De.31, Ja.30,	Q 0.50
Golden Center	N. Y. Curb	...	...	1⅛		
Golden Cycle	N. Y. Curb	1⅜	1⅛	1⅜	No.30, De.10	Q 0.04
Hollinger Consol.	Toronto	22.50	22.20	22.35	Fe.9, Fe.25	0.10
Homestake Mining	New York	60¼	60¼	60¼	Fe.19, Fe.25	M 0.50
Kirkland Lake	Toronto	*98	*85	*88		
Lake Shore	Toronto	18.40	18.00	18.16	Ma.1, Ma.15	0.10
McIntyre-Porcupine	New York	27	26½	27	Fe.1, Ma.1	Q 0.25
Newray	Toronto	*32	*30	*32		
Night Hawk Pen.	Toronto	*5⅜	*5	*5		
Portland	Colo Springs	†*54	†*52	....	Ja.6, Ja.15,	'27 0.02
Rand Mines	New York	....	....	9⅛	Au.23-30	Am.Sh. 1.52
Teck-Hughes	Toronto	6.40	6.10	6.35	Ja.31, Fe. 1	0.05
Tom Reed	Los Angeles	*52	*50	*50	Dec., 1926	0.02
Tough-Oakes	Toronto	*60	*53	*55		
United Eastern	N. Y. Curb	*50	*50	*50	July, 1924	0.05
Vipond Cons.	Toronto	1.64	1.59	1.60	Apr.1 Apr.15	0.03
Wright-Hargreaves	Toronto	10.40	10.15	10.20	Ja15,Fe.1	QX 0.15
Yukon-Alaska Trust	N. Y. Curb	....	....	20		
GOLD AND SILVER						
Carnegie Metals	Pittsburgh	12⅛	12⅛	12⅛		
Con. Cortez	N. Y. Curb	*20	*11	*18		
Con. Virginia	San Francisco	*4⅜	*3⅛	*4⅛		
Continental Mines	N. Y. Curb	...	...	* 4		
Dolores Esperanza	N. Y. Curb	*40	*40	*40	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2	2⅛	De.17, Ja.4	Q 0.08
Tonopah Belmont	N. Y. Curb	...	...	2	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	*1⅛	*1⅛	*1⅛	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	3	3	3	Se.30, Oc.21	SA 0.07½
West End Consol.	N. Y. Curb	*10	*10	*10	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	...	...	*40	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Beaver Consol.	Toronto	*66	*66	*66	May. 1926	0.03
Canadian Lorrain.	Toronto	...	...	*58½		
Castle-Trethewey	Toronto	1.12	1.07	1.12		
Coniagas	Toronto	4.05	4.00	4.05	May, 1924	0.12½
Keeley	Toronto	1.63	1.60	1.62	Fe.28, Ma.	X 0.12
Kerr Lake	N. Y. Curb	*95	*90	*90	Oc.1, Oc.15	SA 0.12½
La Rose	Toronto	*12	*8	*10	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*30	*30	*30	July, 1925	0.05
McKinley-Dar.-Sav.	Toronto	*16½	*14	*17	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.25	3.15	3.20	De.30, Ja.15	0.12½
Nipissing	N. Y. Curb	9⅜	9⅛	9⅜	De.31, Ja.20	Q 0.15
Temiskaming	Toronto	*10	*10	*10	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	4⅜	4⅛	4⅛	De.18, Ja.5,	QX 0.15
Bingham Mines	Boston	44⅛	42	42	De.30, Ja.5	Q 1.00
Cardiff M. & M.	Salt Lake	*43⅛	*42	*42	Fe., 1927	0.10
Chief Consol.	Salt Lake	3.00	2.80	2.90	Oc.10, No.1	Q 0.10
Consti'n Mng. & Mill'g	Spokane	*27	*25	*27		
Erupcion	Boston Curb	*95	*95	*95	De.18, Ja.3	Q 0.10
Federal M. & S.	New York	82⅞	80	82⅛		
Federal M. & S., pfd.	New York	80⅛	78⅛	78⅛	Fe.24, Ma.15	Q 1.75
Hawthorne Mines	N. Y. Curb	*6	*5	*6		
Hecla Mining	N. Y. Curb	14	13	13⅞	Fe.15, Ma.15	Q 0.25
Highland-Surprise	Spokane	*14⅜	*14⅛	*14⅜		
Iron King Mining	Salt Lake	*37	*34	*34		
Keystone Mining	Salt Lake	*45	*38	*45	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*15	*15	*15		
Lucky Tiger-Com.	Kansas City	†7.40	†7.20	....	Ja., 1927	M 0.05
Mammoth Mining	Salt Lake	...	...	2.60	De.17, De.23,	Q 0.25
Marsh Mines	Spokane	2.50	2.00	2.25		
Park Utah	New York	7⅛	7	7⅛	De.15, Ja.2	Q 0.15
Plutus Mining	Salt Lake	2.25	1.80	1.80	Ja.10, Ja.15	Q 0.10
San Rafael	San Francisco	...	...	*28		
Silver King Coal.	Salt Lake	8.15	8.00	8.00	De. 16, Ja.3	0.25
Silversmith	Spokane	*32	*31	*32	Oc.1, Oc.10	Q 0.02
Strattons Mines	Spokane	*41	*38	*41		
Sunshine M. Co.	Spokane	*46	*44	*45		
Tamarack-Custer	Spokane	*37	*36	*36	Sept., 1924	0.25
Tintic Standard	Salt Lake	11.75	11.25	11.75	De.11, Ja.3	0.30
Utah-Apex	Boston	7⅛	6⅛	7	Oc.3, Oc.15	Q 0.25
IRON						
Bethlehem Steel	New York	47⅞	46	46⅛	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	80	74	74	Ja.15, Ja.25	Q 1.00
Colorado Fuel & Iron	New York	62	57⅛	57⅞	May, 1921	0.75
Gt. North'n Iron Ore	New York	22⅛	21	21⅛	Dec.6, Dec.28	0.75
Inland Steel	New York	43	41	42⅛	Fe.15, Ma.1	Q 0.62½
Mesabi Iron	N. Y. Curb	...	...	*95		
Replogle Steel	New York	12⅛	11⅞	12		
Republic I. & S.	New York	⅛	62	64	Fe.15, Ma. 1	Q 1.0
Republic I. & S. pfd.	New York	102⅛	101	101	Ma.15, Ap.1	Q 1.75
Sloss-Sheffield S. & I.	New York	131	129	129	De.10, De.20	Q 1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	108	De.20, Ja.3	Q 1.75½
U. S. Steel	New York	160⅛	157⅜	158⅞	Fe.28, Ma.30	Q 1.75
U. S. Steel pfd.	New York	130	129⅛	129⅞	Ja.29, Fe.26,	Q 1.75
Virginia I. C. & C.	New York	...	...	44	Jan., 1924	1.500
Virginia I.C.&C.pfd	New York	...	...	60⅛	De.15, Ja.2,	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol.	New York	32⅛	32⅛	32⅛	Ja.26, Ja.29	1.45
So. Am. Gold & P.	N. Y. Curb	⅞	3⅜	⅞		
Alum.Co.of Amer.	N.Y.Curb	7⅛	72	...		
Alum. Co. of Amerpf.	N.Y.Curb	102	102	102	De.15, Ja.15	Q 0.50
Vanadium Corp.	New York	39⅞	39	39⅛	Fe.1, Fe.15,	Q 0.75
Patino M. & E.	N. Y. Curb	...	...	25	Nov. 5, 1926	5 sh.
ASBESTOS						
Asbestos Corp.	Montreal	23⅛	22	22⅞	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	85	85	85	De.31, Ja.15,	Q 1.75
SULPHUR						
Freeport Texas	New York	46⅛	43⅜	44⅛	Ja.15, Fe.1	Q 0.50
Texas Gulf, new	New York	54⅜	52⅜	54	Ma.1, Ma.15,	Q 1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	43⅛	41⅜	42⅛	Fe.18, Ma. 1,	Q 0.75
Amer. Metal pfd.	New York	....	....	109⅜	Fe.19, Ma.1	Q 1.75
Amer. Sm. & Ref.	New York	149	143	147⅛	Ja.14, Fe.1,	Q 2.00
Amer. Sm.&Ref.pfd.	New York	121⅜	120⅛	121⅜	Fe.4, Ma.1,	Q 1.75
Consol. M. & S.	Montreal	2.47	2.44	2.45½	De.31, Ja.15	X 6.25
Federated Metals	N. Y. Curb	...	...	13⅜		
Newmont Mining	N. Y. Curb	68⅛	68⅛	68⅛	De.31, Ja.17,	0.60
U. S. Sm. R. & M.	New York	35⅜	34⅜	35⅜	Ja.6, Ja.15,	Q 0.87½
U. S. Sm. R.&M.pfd.	New York	47⅛	46⅛	47⅛	Ja.6, Ja.15,	Q 0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs

LONDON QUOTATIONS—WEEK ENDED FEB. 8, 1927

Name	High	Low	Last		Last Div. Date	Amount
Aramayo Mines (25 frs.)	80/7½	78/9	80/—	Feb.	1927	5 (c.)
British Platinum (£1)	3/7½	2/10½	3/—	Feb.	1925	2½ p.c.
Burma Corpn. (10 rupees)	14/4½	13/9	14/—	Feb.	1927	6 annas*
Bwana M'Kubwa (5s)	6/6	6/—	6/3			
Camp Bird (2s)	5/3	2/10½	3/6			
El Ore (£1)	5/1½	4/9	5/—	Nov.	1924	2½ p.c.*
Esperansa (10s)	—/10½	—/10½	—/10½			
Frontino & Bolivia (£1)	11/9	11/3	11/3	Jan.	1927	5 p.c.
Mexican Corpn. (£1)	10/7½	10/3	10/6			
Mexico Mines of El Oro (£1)	20/—	18/—	20/—	Dec.	1926	3½ p.c.*
N'Changa Copper Mining	18/—	16/6	17/6			
Oroville Dredging (£1)	4/9	4 6	4/9	Dec.	1923	3½ p.c.
Ouro Preto (£1)	2/1½	2/—	2/—	May	1925	2½ p.c.
Rhodesian Congo Border (£1)	80/7½	72/—	80/—			
St. John del Rey (£1)	11/1½	10/—	10/6	June	1925	6½ p.c.
San Francisco Mines (10s)	30/—	29/1½	29/9	Jan.	1927	25s.
Santa Gertrudis (£1)	15/9	14/1½	15/6	Jan.	1927	3½ p.c.
Selukwe (2s. 6d.)	10/6	9/9	10/6	April	1917	6½ p.c.
S. Amer. Copper (2s.)	3/4½	3/—	3/3	Nov.	1917	75 p.c.
Tanganyika (£1)	53/9	46/3	47/6	Aug.	1926	7½ p.c.
Tomboy (£1)	3/6	2/9	3/3	July	1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.025	8.835	9.025	July	1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxatio